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CONCEPT DEFINITION AND EVALUATION CRITERIA FOR THE MOBILE PROTE--ETC(U)
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FINAL REPORT PR 81-14-154

Concept Definition and Evaluation Criteria for the Mobile Protected Weapons System (MPWS) and the Light Armored Vehicle (LAV)

Terry A. Bresnick
Charles P. Annis
Dennis M. Buede

DECISIONS and DESIGNS, INC.

Prepared for
Naval Sea Systems Command
Washington, D.C. 20362

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER PR 81-14-154	2. GOVT ACCESSION NO. AD-A102 879	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) CONCEPT DEFINITION AND EVALUATION CRITERIA FOR THE MOBILE PROTECTED WEAPONS SYSTEM (MPWS) AND THE LIGHT ARMORED VEHICLE (LAV)		5. TYPE OF REPORT & PERIOD COVERED Final Report
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Terry A. Bresnick Charles P. Annis Dennis M. Buede	2	8. CONTRACT OR GRANT NUMBER(s) N00024-80-C-2123
9. PERFORMING ORGANIZATION NAME AND ADDRESS Decisions and Designs, Inc. Suite 600, 8400 Westpark Drive, P.O. Box 907 McLean, VA 22101		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Department of the Navy Naval Sea Systems Command (PMS 300) Washington, DC 20362		12. REPORT DATE May 1981
		13. NUMBER OF PAGES 89
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) LEVEL II		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

DTIC ELECTE AUG 14 1981 S C D

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Marine Corps	Source selection
Weapon systems	Mission area analysis
Armored personnel carriers	Cost effectiveness
Light armored vehicles	Operational effectiveness
Evaluation	Life cycle costs
Multi-attribute utility analysis	Mobility

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The focus of the project described in this report was twofold: to examine Marine Corps' mission-driven needs for a mobile weapons systems, following the guidelines required by OMB Circular A-109; and to establish source selection parameters and performance standards for a light armored vehicle (LAV). While the specific vehicles required are clearly different, both the Mobile Protected Weapons System (MPWS) and the LAV are envisioned to be helicopter-transportable, highly mobile, and able to provide direct fire support and organic antiarmor capability during landing force operations and in subsequent operations ashore.

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FINAL REPORT PR-81-14-154

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CONCEPT DEFINITION AND EVALUATION CRITERIA FOR THE MOBILE PROTECTED WEAPONS SYSTEM (MPWS) AND THE LIGHT ARMORED VEHICLE (LAV)

by

10 *Terry A. Bresnick, Charles P. Annis, ~~and~~ Dennis M. Buede*

Prepared for

Naval Sea Systems Command
Washington, D.C. 20362
Contract N00024-80-C-2123

15

11 May 1981

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FIGURES

CONCEPT DEFINITION AND EVALUATION CRITERIA
FOR THE MOBILE PROTECTED WEAPONS SYSTEM (MPWS)
AND THE LIGHT ARMORED VEHICLE (LAV)

1.0 INTRODUCTION

This final report describes the work accomplished under contract N00024-80-C-2123 during the period 23 April 1980 - 30 April 1981. The purpose of the project was to examine Marine Corps' mission-driven needs for a mobile weapons system; the work was performed for the Chief, Firepower Division, and later, the Chief, Light Armored Vehicle (LAV) Directorate, Marine Corps Development and Education Command (MCDEC). The study employed numerous experts in the areas of threat, tactics, and weapons technology to provide subjective judgments and objective data necessary for such an analysis. This use of experts allowed Marine Corps decisions to be made by Marines with minimum impact from outside consultants. The framework for the analysis in the study was multi-attribute utility analysis (MAUA), a technique in which these data and judgments are combined in a logical and defensible manner.

The study initially focused upon conceptual designs for a mobile weapons system. A concept definition phase was conducted for a Mobile Protected Weapons System (MPWS) with an Initial Operating Capability (IOC) of fiscal year 1988. The Marine Corps had previously conducted mission area analyses and had written a mission element need statement (MENS) that validated the requirement for the MPWS. In order to operate within the guidelines of OMB Circular A-109, the Marine Corps wanted to specify mission needs and then allow industry to provide innovative applications of advanced technology to meet these needs. To that end, Decisions and Designs, Inc. (DDI) assisted in the preparation of a Threat and Requirements Statement and other materials used at the pre-bidders conference for the conceptual MPWS.

At the conclusion of the conceptual or initial MPWS analysis, the emphasis shifted to an analysis of near-term existing vehicles. This topic had been receiving high-level Marine Corps and Congressional attention in the light of the recent interest in the Rapid Deployment Force. Study group efforts were then focused on the specification of requirements and evaluation criteria for an off-the-shelf Light Armored Vehicle. The LAV group was tasked with determining absolute performance standards and specific evaluation parameters that could be used for source selection. As in the analysis of the MPWS, a multi-attribute utility framework was used to structure and evaluate the LAV.

While the specific vehicle required in each time frame is clearly different, both the MPWS and LAV are envisioned to be helicopter-transportable, highly mobile, and able to provide direct fire support and organic antiarmor capability during landing force operations and in subsequent operations ashore. While the two phases of the study addressed independent weapon systems, the analysis of the LAV built upon the earlier analysis of the MPWS.

The remainder of this report describes in more detail the work performed in both phases of the contract. Section 2.0 provides an overview of the conceptual design for the MPWS, while Section 3.0 discusses the source selection structure for the LAV.

2.0 MPWS CONCEPTUAL DEFINITION

Recent emphasis within the Department of Defense (DOD) has focused upon identifying mission needs rather than specifying systems hardware. This approach calls upon the military to give industry the opportunity for innovation, for maximum use of new technology, and for design-to-cost products. The guidelines for this approach are contained in OMB Circular A-109. This circular requires mission analyses to be conducted on a continuing basis, and requires the development of a mission element need statement, or MENS, that addresses specific mission deficiencies. In general, A-109 requires that requests for new acquisitions be stated as mission needs performance parameters rather than in terms of explicit equipment needs. It was in the context of A-109 that the study group focused their efforts.

The study began with a review of the perceived threat in the 1985 - 1990 time frame. The enemy threat capabilities are those of the Soviet/Warsaw Pact forces and Soviet Surrogate forces found throughout the world. To combat these forces, the Marine Corps concept for amphibious operations requires increased tactical mobility to project direct-fire weapons systems ashore to support the landing force. Current and projected tanks have the required firepower but cannot be lifted by helicopter, hence the need for an MPWS. Figures 2-1 and 2-2 summarize the expected armored threats in the near- and long-term.

From a historical perspective, the need for a helicopter-transportable weapons system with a direct-fire antiarmor

Near Term Period
1982 – 1988

PROBABILITIES OF FACING T-72/64 TANK

GEOGRAPHIC AREA	WARSAW PACT		ANY ENEMY	
	Tank	Any Armored Combat Vehicle	Tank	Any Armored Combat Vehicle
ANYWHERE	.4	.1	.1	.05
NATO CENTRAL FRONT	.7	.2	.7	.2
NATO NORTHERN FLANK	.3	.08	.3	.08
NATO SOUTHERN FLANK	.3	.08	.3	.08
MIDDLE EAST (Including N. Africa)	.2	.06	.1	.02
FAR EAST (Korea, USSA, PRC)	.2	.06	.05	.02
SOUTHEAST ASIA	–	–	.03	.01
LATIN AMERICA	–	–	.03	.01
SOUTHERN AFRICA	–	–	.03	.01

Figure 2-1

EXPECTED ARMORED THREATS IN THE NEAR-TERM PERIOD

Far Term Period
1988 – 1998

PROBABILITIES OF FACING T-72/64 TANK

GEOGRAPHIC AREA	WARSAW PACT		ANY ENEMY	
	Tank	Any Armored Combat Vehicle	Tank	Any Armored Combat Vehicle
ANYWHERE	.7	.3	.3	.1
NATO CENTRAL FRONT	.9	.4	.9	.4
NATO NORTHERN FLANK	.7	.3	.7	.3
NATO SOUTHERN FLANK	.7	.3	.7	.3
MIDDLE EAST	.6	.25	.4	.08
FAR EAST	.6	.2	.3	.05
SOUTHEAST ASIA	–	–	.1	.03
LATIN AMERICA	–	–	.1	.03
SOUTHERN AFRICA	–	–	.1	.03

Figure 2-2

EXPECTED ARMORED THREATS IN THE FAR-TERM PERIOD capability has been apparent since the early 1970's. Figure 2-3 reviews the historical events contributing to this need.

Initially, a systems design methodology was used to investigate design constraints and define structural "building blocks." Initial analysis revealed that a more efficient approach to viewing cost-benefit considerations would be that of multi-attribute utility analysis (MAUA).

In specifying mission needs, three scenarios for the MPWS were examined. These included an assault support role (offensive), a blocking position role (defensive), and a role in subsequent infantry operations ashore. While these roles are not all-inclusive, they were deemed representative of the spectrum of most demanding combat roles for the MPWS.

Certain requirements for the conceptual MPWS were considered as absolute and non-negotiable by industry. That is, any contender for the MPWS must meet all of the absolute requirements or it would receive no further consideration. These requirements included helicopter transportability, tactical and strategic air transportability, compatability with an amphibious environment, fordability, and an N.B.C. overpressure capability.

The remaining requirements for the MPWS were treated as variable performance parameters. These were factors that could vary greatly with system design and were available to industry for making technical, operational, and cost trade-offs. A hierarchical structure was used to develop a logical decomposition of these parameters into specific system characteristics that could be evaluated. This structure is shown in

MPWS Requirements Background

Intuitive Need (Early 1970's)

- **Diminishing Naval Gunfire Support**
- **Increasing Enemy Air Capability**
- **Eroding Assault Gun Assets**
  - *ONTOS/Recoilless Rifle/ 3.5 in Rocket Launcher Deleted From Inventory*
- **Requirement for Increased**
  - *Armor Protection*
  - *Firepower*
  - *Maneuverability*

Reinforcement

- **1972-1973, MPWS Study**
- **1976 DARPA/USMC/USA ACVT Program**
- **1978 MPWS ROC**
- **1978-$5M Congressional Add-On**
- **1979-$5M Congressional Add-On**
- **1979 IOC of 1988 Approved**
- **1979 Acquisition Strategy Defined**

Substantiation

- **1978-1980, MPWS Concepts Study (SRI)**
- **1979-1980 ARMVAL**
- **1979-1980 Threat Definition**
- **1979-1980 Mission Area Analysis**
- **Mission Element Needs Statement**
- **1979-1980 Field Analysis Concept Test**
- **1979-1980 Foreign Vehicle Evaluation Study**
- **July 1980 Milestone — 0**

Figure 2-3

MPWS REQUIREMENTS BACKGROUND

Figure 2-4. The major parameters were operational effectiveness, life-cycle costs, and other considerations. Operational effectiveness was further broken down by mission scenario, and at lower levels, by specific performance factors such as firepower, mobility, survivability, reliability/availability/maintainability (RAM), and helicopter transportability. These factors were, in turn, decomposed into detailed criteria that could be measured and evaluated.

A utility curve over the range of acceptable performance, with associated rationale, is associated with each item at the bottom of the structure. Trade-offs can be developed for any set of bottom-level attributes to offset weaknesses in others. However, the improvements in performance as indicated by the curves for each parameter are not equally important in the overall analysis. Therefore, a weighting procedure was applied to the parameters to allow meaningful relative comparisons. In this study, the weights served to highlight the differences among the three scenarios. While the utility curves remain constant across the scenarios, their relative importance may change significantly. The utility curves and weights were developed in working sessions with representatives of the MPWS program team, Marine Corps operations analysts, potential users, and other tactical and technical experts. A list of the study participants is found at Appendix A.

The overall hierarchical structure, the weights, and the associated curves and rationale were used to produce a document for enclosure in the Request for Proposal (RFP) for the MPWS. This document was the "Threat and Requirements Statement: United States Marine Corps Mobile Protected Weapons System (MPWS)," and is included in this report as Appendix B. It

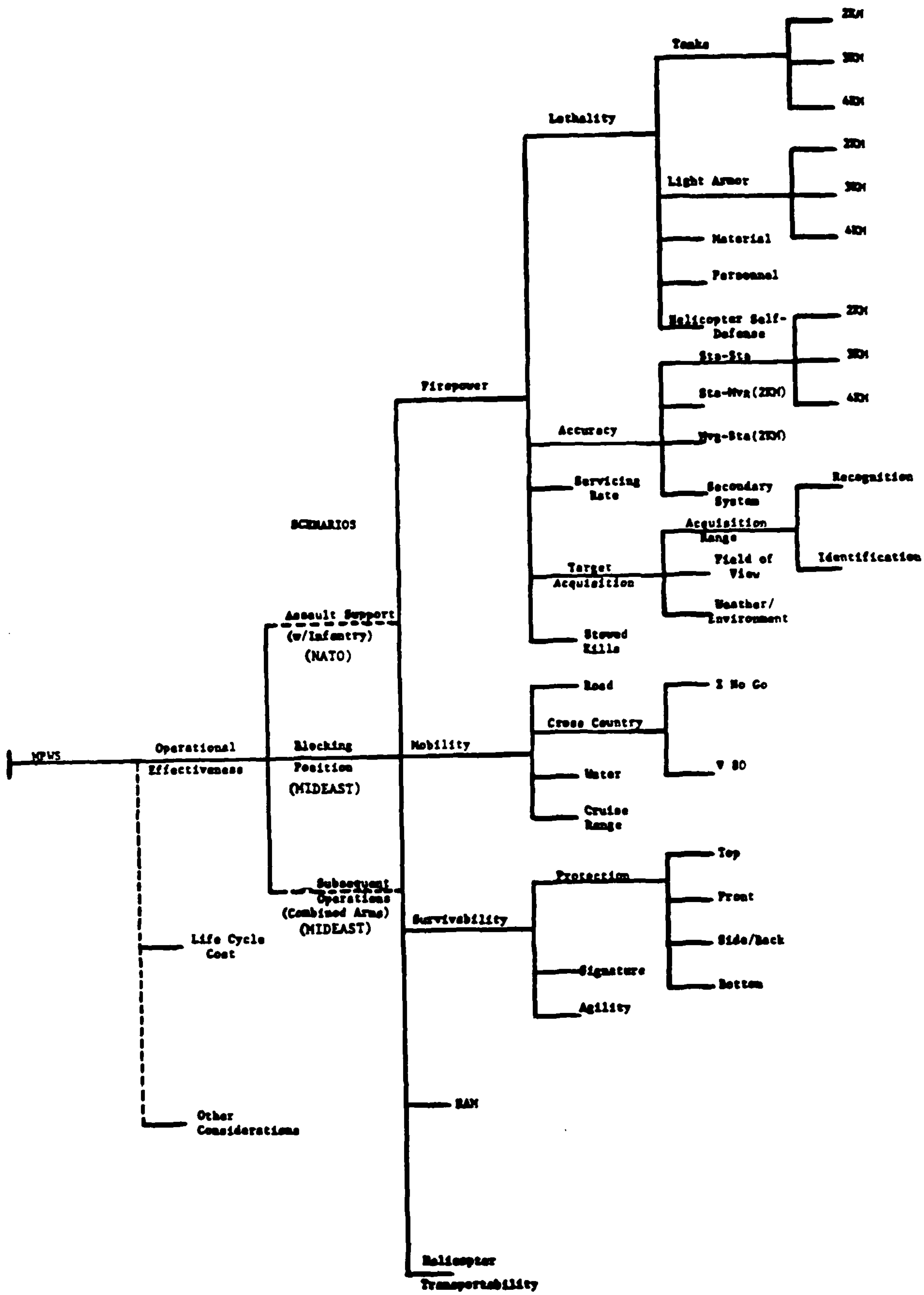

Figure 2-4
COMPONENTS FOR DESIGN CONSIDERATION

contains a detailed description of the history, threat description, requirements, hierarchical structure, utility curves, weights, and rationale produced under this contract.

3.0 SOURCE SELECTION STRUCTURE FOR THE LIGHT ARMORED VEHICLE (LAV)

3.1 General

In response to recent emphasis on the Rapid Deployment Force (RDF), the Marine Corps has projected a requirement to field a Light Armored Vehicle (LAV) with an Initial Operating Capability of FY 1983. Therefore, the LAV Directorate, MCDEC, was tasked with evaluating current off-the-shelf systems, and possible variants thereof, to determine their acceptability for the anticipated roles of an LAV.

This analysis was done subsequent to the concept study for a Mobile Protected Weapons System and built upon the previously developed models of threat and performance requirements for the MPWS as discussed in Section 2.0. Four two-day sessions with an LAV project team were spent modeling the LAV evaluation process, with the end product being evaluation criteria to be used in the source selection plan.

The major difference between the LAV and MPWS analyses is the need to develop the best possible candidate weapon system within a short period of time rather than to structure requirements for industry to use in developing an acceptable system. For that reason, many of the performance criteria used for MPWS were relaxed for LAV to fall more in line with off-the-shelf technology and capabilities. "Off-the-shelf" vehicles must meet the following requirements as stated in the LAV request for proposal:

A. The offeror has previously produced the vehicle, the vehicle is commercially available, and the vehicle is substantially composed of components which are in commercial or military in-service use.

B. The offeror must deliver test vehicles as specified 60 days after the contract award, meet the specified technical and performance requirements, and possess the capability and capacity to produce and deliver, in the configuration required, the first year vehicle production requirements.

While the primary procurement is for a Light Assault variant of the LAV, an important consideration is the longer-term availability of other variants including:

Assault Gun
Command and Control
Air Defense
Logistics
Antitank
Mortar Carrier
Engineer
Maintenance/Recovery
Ambulance.

As with the MPWS study, this analysis began with the review of the Soviet threat, but concentrated on the near-term period. The threat capabilities considered were those of the Soviet Warsaw Pact forces and Soviet Surrogate forces throughout the world. Again, the need for increased tactical mobility and an increased direct-fire capability in supporting a landing force ashore were the significant factors driving the requirements for an LAV.

A complete description of the model structure, minimal acceptable criteria, evaluation criteria, scores, weights, and rationale is contained in the report entitled "Revised Source Selection Criteria for the United States Marine Corps Light Armored Vehicle (LAV)"; it summarizes the 3-4 March 1981 working session held at DDI. This document is considered to be source-selection-sensitive and is controlled by the Chief, LAV Directorate, MCDEC. Nonsensitive portions are described in this report as a ready reference for the source selection process.

3.2 The Source Selection Process

The Source Selection Plan for the LAV calls for a two-phased evaluation. In the first phase, responses to the LAV Request for Proposal (RFP) will be evaluated by a paper study with the intent of reducing the number of candidates to a maximum of four. Contenders must initially meet minimum acceptable requirements (described below) in all areas. Failure to meet any one of these requirements will eliminate the candidate from further consideration. Those passing this first filter will be subject to further evaluation in the paper study. In the second phase, the finalists will be awarded contracts for three to four production systems and will be evaluated in terms of the production facilities, system performance, and cost.

The schedule for the LAV selection process is shown in Figure 3-1.

3.3 Source Selection Evaluation Criteria

The LAV Source Selection Plan describes two types of criteria. First, certain requirements for the LAV are termed

PROGRAM PLANNING CHART (3-YEAR)

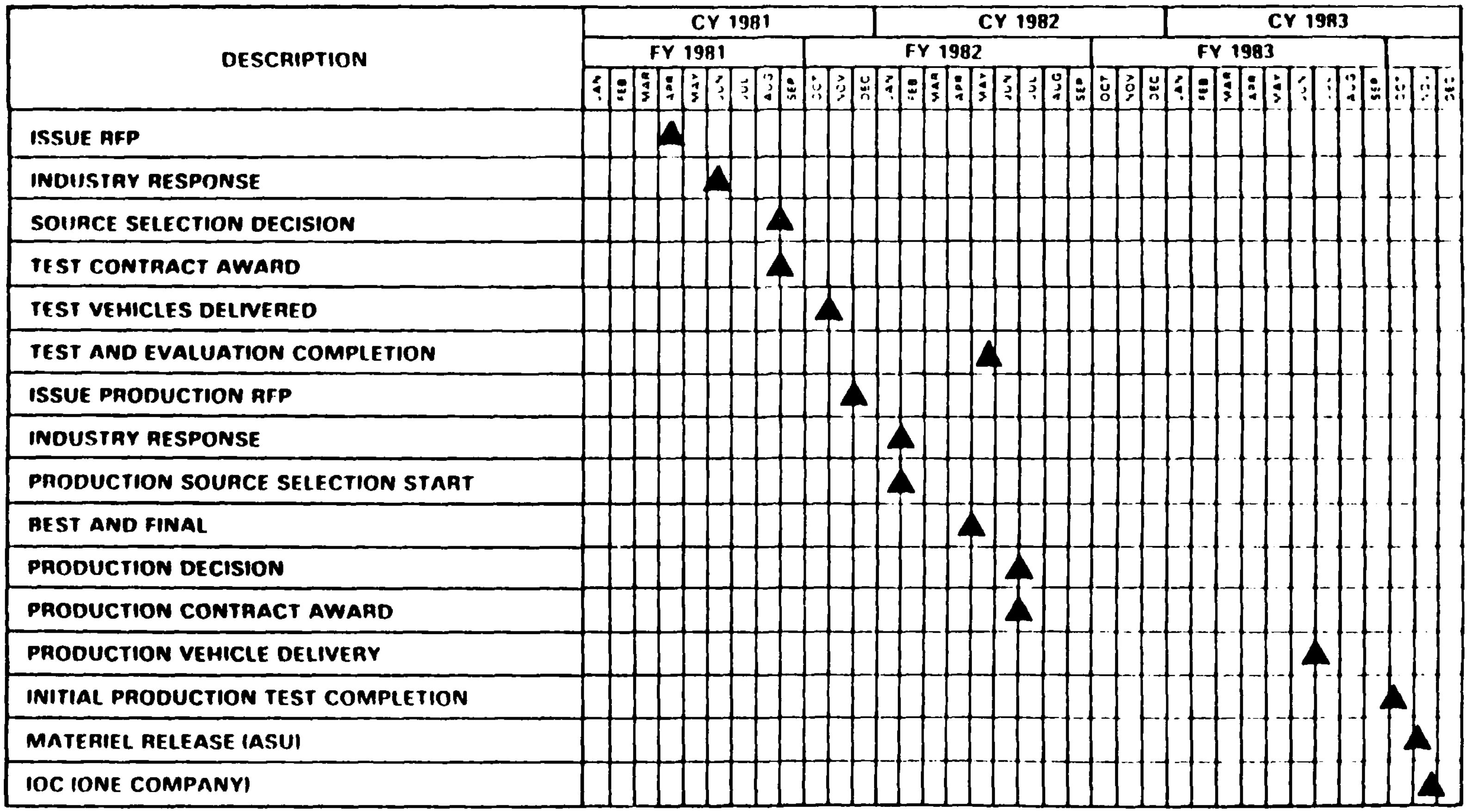

Figure 3-1

SCHEDULE FOR THE LAV SELECTION PROCESS

minimum acceptable criteria, meaning that candidate systems must meet these minimum criteria or not be considered responsive contenders. These criteria include requirements such as helicopter transportability and compatibility with an amphibious shipping environment. A detailed description of the minimum acceptable criteria is found in Appendix C.

The remaining criteria are called evaluation criteria. They represent improvement over the minimum acceptable levels (if a minimum is applicable) and are described by an evaluation scale for each criterion. All candidates passing the first filter of minimum acceptable criteria will then be subject to further judgment using these evaluation criteria. The criteria include detailed aspects of technical performance (e.g., firepower, mobility) and production (e.g., quality control, integrated logistics support). The evaluation criteria, as well as the upper and lower limits of their evaluation range, are described in Appendix D.

While not all criteria described in the RFP will be examined prior to the production phase, the criteria used for the "paper study" will also be used in the production phase. These criteria have been rank ordered and weighted by importance considerations. The hierarchical structure that incorporates the evaluation criteria is shown in Figure 3-2.

3.4 Status of the LAV

The RFP for the LAV was issued on 14 April 1981, and the Source Selection Evaluation Board is scheduled to convene on 10 June 1981. The evaluation criteria contained in the RFP are directly based upon the work accomplished under this current contract.

- technical performance-LA
  - RAM-D
    - maintainability
      - ease, speed
      - commonality
        - other variant
        - fielded systems
    - reliability
      - automotive
      - turret
    - durability
      - automotive
      - turret
  - human factors/safety
    - crew proficiency
      - gunner
      - driver
      - commander
    - squad proficiency
      - fatigue
      - vision
      - firing ports
      - entry/exit
    - safety
      - ventilation
      - other
    - storage
    - vision
      - driver
        - night/vn
        - field view
      - commander
        - night/vn
        - field view
      - gunner
        - night/vn
        - field view
  - mobility
    - % No Go
      - German dry
      - German snow
      - Mideast dry
    - V 80
      - German dry
      - German snow
      - Mideast dry
    - fuel economy
    - cruising range
    - road speed
    - swim capability
      - speed
      - preparation time
      - surf capability
  - survivability
    - agility
      - acceleration
      - braking
      - turning
    - protection
      - signature
        - noise
        - visual dust
        - visual presented area
        - thermal
      - armor
    - fire detection/suppression
  - transportability
    - helicopter
    - fixed wing
      - C-130
      - C-141
      - C-5A
  - configuration
  - firepower
    - accuracy
    - # ready rounds
    - # stowed rounds
    - lethality
  - environment
    - NBC
      - collective/individual
      - detection
    - climatic

Figure 3-2
HIERARCHICAL EVALUATION STRUCTURE

```
                                                    |-capability
                           |-production base---|
                 |         |                   |-prior production
                 |-schedule-|-lead times
                 |         |
                 |         |-25mm availability
                 |
                 |
                 |         |-plan
                 |         |
                 |-quality -|-capability
                 |assurance |
                 |         |-past performance
                 |
                 |
                 |         |-assault gun------|-availability
                 |         |
                 |         |                  |-design
                 |         |-command/control--|
                 |         |                  |-availability
                 |         |
                 |         |                  |-design
                 |         |-logistics--------|
                 |         |                  |-availability
                 |         |
                 |         |                  |-design
                 |-variants-|-mortar-----------|
                 |         |                  |-availability
                 |         |
                 |         |                  |-design
                 |         |-engineer---------|
                 |         |                  |-availability
                 |         |
production-|     |         |                  |-design
                 |         |-antitank---------|
                 |         |                  |-availability
                 |         |
                 |         |                  |-design
                 |         |-maint/recovery---|
                 |         |                  |-availability
                 |         |
                 |         |                  |-design
                 |         |-ambulance--------|
                 |                            |-availability
                 |
                 |         |-technical pubs
                 |         |
                 |         |-provisioning
                 |         |                  |-baseline
                 |         |-logistics spt----|
                 |         |                  |-capability
                 |-ILS------|-maintenance spt
                 |         |
                 |         |-training
                 |         |
                 |         |-support equipment
                 |         |
                 |         |-past performance
                 |
                 |
                 |         |-subcontractors
                 |         |
                 |         |-past performance
                 |         |
                 |-project -|-plan
                 |management|
                           |-configuration management
                           |
                           |-technical staff
```

Figure 3-2 (Continued)

HIERARCHICAL EVALUATION STRUCTURE

- technical perform-ance-AC
  - RAM-D
    - maintaina-bility
      - ease, speed
      - commonality
        - other variant
        - fielded systems
    - reliability
      - automotive
      - turret
    - durability
      - automotive
      - turret
  - human factors/safety
    - crew proficiency
      - gunner
      - driver
      - commander
    - safety
      - ventilation
      - other
    - storage
    - vision
      - driver
        - night/wx
        - field view
      - commander
        - night/wx
        - field view
      - gunner
        - night/wx
        - field view
  - mobility
    - % No Go
      - German dry
      - German snow
      - Mideast dry
    - V 80
      - German dry
      - German snow
      - Mideast dry
    - fuel economy
    - cruising range
    - road speed
    - swim capability
      - speed
      - preparation time
      - surf capability
  - surviva-bility
    - agility
      - acceleration
      - braking
      - turning
    - protection
      - signature
        - noise
        - visual dust
        - visual presented area
        - thermal
      - armor
    - fire detection/supression
  - transport-tability
    - helicopter
    - fixed wing
      - C-130
      - C-141
      - C-5A
  - firepower
    - shell/fuse mix
    - accuracy
    - # ready rounds
    - # stowed rounds
    - penetration
  - environment
    - NBC
      - collective/individual
      - detection
    - climatic

Figure 3-2 (Continued)

HIERARCHICAL EVALUATION STRUCTURE

REFERENCES
MPWS/LAV WORKING DOCUMENTS

NOTE: These references are a series of working documents prepared during the course of this contract, usually during the meetings of the working group assembled by the Firepower Division and Light Armored Vehicle Directorate, MCDEC, and DDI analysts.

Series No.	Title
1	"Mission Analysis of United States Marine Corps Mobile Protected Weapon Systems (MPWS)"; Summary of Meetings Held on 5-6 February 1980.
2	"Initial Multiple Attribute Value Analysis of United States Marine Corps Mobile Protected Weapon Systems (MPWS)"; Summary of Meetings Held on 5-6 March 1980.
3	"Second Multiple Attribute Value Analysis of United States Marine Corps Mobile Protected Weapon Systems (MPWS)"; Summary of Meetings Held on 11-12 March 1980.
4	"Continuation of Multiple Attribute Value Analysis of United States Marine Corps Mobile Protected Weapon Systems (MPWS)"; Summary of Meetings Held on 17-18 March 1980.
5	"Mission Driven Performance Analysis of United States Marine Corps Mobile Protected Weapon Systems (MPWS)"; Summary of Meetings Held on 8-9 April 1980.
6	"Preliminary Threat and Requirements Statement: United States Marine Corps Mobile Protected Weapon Systems (MPWS)"; Summary of Meetings Held on 14-15 April 1980.
7	"Preliminary Performance Analysis of United States Marine Corps Light Armored Vehicle (LAV)"; Summary of Meetings Held on 29-30 May 1980.
8	"Continuation of Performance Analysis of United States Marine Corps Light Armored Vehicle (LAV)"; Summary of Meetings Held on 8-9 July 1980.

9 "Evaluation Criteria for the United States Marine Corps Light Armored Vehicle (LAV)"; Summary of Meetings Held on 4-5 September 1980.

10 "Revised Source Selection Criteria for the United States Marine Corps Light Armored Vehicle (LAV)"; Summary of Meetings Held on 3-4 March 1981.

APPENDIX A

STUDY PARTICIPANTS

MPWS Contributors

MCDEC, Firepower Division	Col. Larry Williams *(Chief)* Mr. James McGillicuddy *(Deputy Chief)* LtCol. John Houtchens *(MPWS FACT Director)* LtCol. Don Johnson *(Force Structure Study)* Maj. Barry Montgomery *(MPWS Deputy Project Officer)* Cpt. Frank Zink, Jr. *(MPWS Deputy Project Officer)* Cpt. Steve W. Miller *(MPWS FACT, 3rd Tank Bn)*
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DTNSRDC	Mr. Steve Scharf
U.S. Army ARENBD, Combat Vehicle Technology Office	Mr. Dave Strimling *(Technology Directorate)* Cpt. Joseph Jennings Mr. Phillip Allen

APPENDIX B

THREAT AND REQUIREMENTS STATEMENT

THREAT AND REQUIREMENTS STATEMENT: UNITED STATES MARINE CORPS MOBILE PROTECTED WEAPON SYSTEM (MPWS)

1.0 INTRODUCTION

1.1 General

Recent emphasis within the Department of Defense (DoD) has focused upon identifying mission needs rather than specifying system hardware, and on early reliance upon industry for innovation, new technology, and design-to-cost in the system acquisition process. For a mission oriented approach, clear and understandable guidance concerning mission needs must be provided to industry, particularly at the system concept formulation stage. Such guidance should be sufficient to enable industry to suggest feasible technical, operational, and cost trade-offs.

This document provides threat and requirements information for a U.S. Marine Corps (USMC) Mobile Protected Weapons System (MPWS). It was developed by USMC and civilian technical and operational personnel to describe mission-oriented considerations for MPWS and to communicate these considerations to industry.

1.2 MPWS History

An intuitive need for a highly mobile, helicopter-transportable weapons system which can provide the landing force assault fire support as well as an antiarmor capability first became apparent in the early 1970's. There were several contributing factors:

- Naval gunfire support assets, so important during an amphibious assault, were steadily decreasing.

- Navy combatant ships with suitable guns for shore bombardment were being retired without replacements, or being replaced with ships less capable of providing gunfire support to amphibious forces.

- The retirement from the Fleet Marine Force (FMF) of the ONTOS, a light, mobile, antitank weapon system carrying six 106 millimeter (mm) recoilless rifles.

- The retirement of the crew-served individual 106mm recoilless rifle.

- The deletion of the 3.5-inch rocket launcher from the Marine Corps inventory.

- At a time when naval gunfire and direct-fire weapons were decreasing, the Soviet and Soviet aligned forces increased their capability with a wide array of armored weapons systems, including tanks, armored personnel carriers, and lightly armored weapons platforms.

The need for an MPWS was reinforced by a 1972-1973 Marine Corps Development and Education Command (MCDEC) study, which projected threat and friendly forces in a variety of scenarios and concluded that a lightweight, highly mobile and agile, helicopter-transportable weapons system capable of supporting the infantry against armor, materiel, and personnel targets would substantially contribute to success in future (1985-95) combat.

In 1976 a joint program was initiated involving the Defense Advanced Research Projects Agency, the Army, and the Marine Corps, for the purpose of determinir the appropriate actions to be taken by the Army and the Marine Corps concerning the development of lightweight combat vehicles. This effort, known as the Armored Combat Vehicle Technology (ACVT) Program, would investigate, through the use of test-bed hardware, comprehensive experimentation and analysis, the utility of future lightweight armored vehicles. In support of this effort, the 75-millimeter gun was chosen as the Medium Caliber Antiarmor Automatic Cannon (MCAAAC). The Marine Corps was particularly interested in this gun development because it showed promise of providing a hypervelocity gun with relatively low impulse forces, thus increasing the possibility of mounting an effective antiarmor weapon on a lightweight vehicle.

In 1978, the Marine Corps promulgated a requirement for the Mobile Protected Weapons System (MPWS). This need specified in greater detail the characteristics set forth in the earlier MCDEC MPWS study, and placed greater emphasis on the antitank capability.

Further reinforcement of the need for the MPWS came in Fiscal Years 1979 and 1980 from the Congress. In each of those two years, the Congress added $5 million to the MPWS research and development efforts. By these actions, the Congress joined the Marine Corps in recognizing the requirement for a lightweight armor vehicle/ MPWS capability.

In accordance with acquisition procedures contained in OMB Circular A-109, Mission Area Analysis (MAA) has been continuous, and a Mission Element Need Statement has been developed stating that:

● Amphibious forces possess capabilities that are uniquely featured by their responsiveness to the maritime aspects of the national strategy. Amphibious warfare requires the full spectrum of capabilities from naval combat effectiveness off-shore and in the air to the close combat mission ashore. The close combat capability provides the mobility, shock action and portions of the firepower necessary to enable landing forces to successfully attack and destroy enemy personnel and materiel, breach their defenses, link up surfaceborne with helicopterborne forces, defeat infantry and mechanized counterattacks and exploit success in combat ashore.

● Capabilities currently possessed by the landing force provide limited mobility and direct fire combat power to enable assault units to rapidly close with and destroy enemy forces. Mobility and direct fire support capabilities required to enhance current capabilities are:

(a) helicopter-transportability of weapons systems by heavy-lift helicopter;

(b) vehicle and crew survivability through armor protection from nearby artillery airbursts and medium-caliber direct fire weapons firing at medium range;

(c) rapid cross-country mobility, agility, and endurance without significant degradation of on-road capability and capable of competing with the expected mobility of the threat;

(d) an on-board weapons suite with a long-range, high kill probability capability against armored, light armored, materiel, and personnel targets characteristic of the threat;

(e) the ability to engage and defeat the target spectrum in all weather conditions;

(f) NBC detection and protection.

OSD has directed the U.S. Marine Corps as lead service, in conjunction with the U.S. Army, to conduct a joint test and evaluation of advanced lightweight antiarmor vehicles (ARMVAL). This effort, utilizing surrogate vehicles under instrumented conditions, should produce data on effectiveness, survivability, ammunition usage rates and other data pertinent to the MPWS.

The U.S. Marine Corps will conduct a Field Analysis Concept Test (FACT) to refine, analyze, and validate concepts of employment and will integrate the results of this program into our force structure analysis. The tests will be conducted in the mountain desert environment at the Marine Corps Air Ground Combat Center (MCAGCC) in California. In addition to using organic equipment (AAVs, M60A1s, TOW, etc.), the Marine Corps will be employing Army M113A1 vehicles and the COUGAR/ GRIZZLY family of light armored vehicles on lease from Canada. The Canadian vehicles will be employed as surrogates through various mission profiles.

The FACT effort will also contribute to Marine Corps mobile Mechanized Combined Arms Task Force operation exercises and evaluations, which are conducted at the MCAGCC and which have resulted in revised tactics and techniques for mechanized and close air support operations in the projected environment.

The Marine Corps Operations Analysis Group (part of the Center for Naval Analysis [CNA]) has been actively conducting a detailed assessment of domestic and foreign light armored vehicles--both wheeled and tracked. Efforts are continuing.

To expedite the program, an Acquisition Strategy has been prepared prior to Program Initiation (Milestone O) which is scheduled for July 1980. This is a comprehensive and flexible strategy which incorporates the standard acquisition processes of design, prototype fabrication, and test to develop the MPWS. It takes advantage of competition to reduce costs, and focuses on innovation to ensure that up-to-date technology is utilized in the MPWS. The strategy provides for acquisition alternatives for a 1986 Initial Operating Capability (IOC) and/or a 1988 IOC:

- Program Initiation July 1980;

- An IOC 1986 provides the option of a hybridization of currently available weapons systems to fill the need;

- An IOC 1988 is development and fielding of a conceptual vehicle and anticipates the availability of the 75mm MCAAAC cannon.

1.3 Mission

The Missions of MPWS are fully documented in MPWS Mission Profile, Supplement B to the Statement of Work for MPWS (N00024-80-PR-20039, dated 1 April 1980).

2.0 THREAT

2.1 Threat and Operational Capability Requirements

2.1.1 Threat - Potential enemy threats confronting the United States in the near- to long-range period are fully developed in the U.S. Marine Corps Long-Range Plan (MLRP) and U.S. Marine Corps Mid-Range Plan (MMRP), CMC Project No. 30-72-01 (Study Report on MPWS), Mission Area Analysis: Amphibious Warfare (Proposed), and Development Threat Assessment, LVTX/MPWS (January 1980). An analysis of the threat discussed in these documents reveals increasing combat capabilities of the potential enemies:

(1) Potential adversaries will take advantage of the availability of sophisticated, highly effective and highly mobile weaponry in all levels of conflict.

(2) The Marine Corps must be prepared to fight under all climatic and terrain conditions.

(3) This threat assessment addresses those portions of the Amphibious Objective Area (AOA) from the line of departure for landing craft, inland to a depth of 45-50 kilometers. Threat capabilities are those of Soviet/Warsaw Pact forces and Soviet surrogate forces increasingly liable to be encountered in Europe, Africa, the Middle East, Asia, and Latin America. Soviet style mid-east forces may be considered as those forces of regional Soviet client states which are armed and equipped with Soviet weaponry, and trained to conduct operations in the manner of Soviet forces. In practice, they may be considered as a mirror image of a comparable type Soviet force; however, the combat capabilities and fighting qualities of a given force may vary widely. A common characteristic shared by all of these forces is their

near-total dependence upon the USSR for the material means of conducting war. None of these regional client states possesses an industrial base sufficient to equip its own armed forces, nor sufficient industrial capacity to manufacture replacement parts or major end item facsimiles of Soviet equipment.

Third world military equipment, configuration, and fighting ability varies widely. Equipment ranges from Soviet to Western origin and from obsolescent to sophisticated recent design. Few third world nations possess an industrial capability to become self sufficient in weapons manufacture in the forseeable future. Quality of individual troops in most third world nations is generally below Western or Soviet standards, being largely drawn from a social base lacking in education and technology.

(4) As with all Soviet military doctrine, the principles of defense against amphibious assault have as their goal the creation of conditions which will allow the Soviet commander to initiate decisive action while denying the landing force commander this same capability. In furtherance of this goal, the Soviet defense is based upon high-intensity mobile operations using large numbers of tanks and armored fighting vehicles, extensive use of supporting arms and tactical aviation, and echeloned defense-in-depth deployed in an integrated combined arms concept.

(5) As an outgrowth of this concept of defense, certain Soviet weapons systems will be of particular concern. The mobility, firepower, and protection offered by tanks and armored fighting vehicles will afford the Soviet commander a decided advantage against Marine landing forces as they are presently equipped. This capability will be greatly

enhanced by the introduction of the T-72 and T-80 series tanks with their vastly improved armor protection, power plants, armament and fire control systems. More than 200 such tanks will be encountered in a representative motorized rifle division, the primary tactical element in defense against amphibious assault. Infantry mobility and fighting capability will also increase with the introduction of improved armored fighting vehicles of the BMP, BMD, BTR family, more than 400 of which will be encountered in the motorized rifle division.

In addition, infantry in prepared defensive fortifications will also confront both waterborne and helicopterborne assault elements. The Soviet commander will also enjoy an increased capability to employ air and artillery-delivered ordnance against the landing force. Tactical aviation will expand dramatically with the widespread use of attack helicopters such as the Mi-8 (HIP), the Mi-24 (HIND) and their successors, as well as fixed-wing attack aircraft such as the MiG-27 (FLOGGER D) and its replacement, the ground support fighter. Artillery will increase both in numbers and mobility, with the self-propelled 122mm and 152mm gun/howitzers playing an expanding role. An added dimension of serious proportions will be the Soviet capability and doctrinal willingness to employ nuclear munitions and conduct chemical operations using a variety of incapacitating and lethal agents.

2.1.2 The operational capability requirement - The Marine Corps' future landing force concept for amphibious operations requires increased tactical mobility to project direct-fire weapon systems rapidly ashore in sufficient numbers to support the landing force. Helicopterborne assault elements are without the shock effect and firepower provided by tanks until linkup with surfaceborne forces.

Future operational requirements are for more suitable vertical and surface assault speeds than are presently available. The current and projected tank possesses the required firepower; however, because of its size and weight, it cannot be transported by current and projected helicopters. Tanks require a large number of heavy amphibious landing craft to project them ashore. There is a need for an MPWS that can provide direct fire support to the landing force that is effective in all weather and visibility conditions. The MPWS must be capable of successfully attacking armored, materiel, and personnel targets while providing the crew protection from enemy small arms and indirect fire.

(For capability requirements other than armor, refer to the MPWS Mission Element Need Statement [MENS].)

3.0 PERFORMANCE REQUIREMENTS

3.1 General Performance Requirements

The Marine Corps requirements demand an affordable weapons system that is highly mobile, helicopter transportable, compatible with amphibious operations, and able to provide direct-fire support during landing force operations. The weapons system must provide protection from suppressive fires and be capable of engaging and defeating armored, personnel, and materiel targets.

To specifically define these requirements for industry, mission-related scenarios have been established, each scenario emphasizing different capabilities of the MPWS. The approach to MPWS design is mission-directed and builds upon related programs (e.g., ACVT, ARMVAL). The intent is to communicate timely guidance to industry that is directed at realistic goals and which can be used for design trade-offs to achieve the most capable weapon system for the Marine Corps.

3.2 Scenarios

In defining the mission needs for the MPWS, three scenarios were considered. These scenarios represent the spectrum of scenarios that drives the design of MPWS. The relative importance of each parameter in the design process changes as a function of scenario.

3.2.1 Scenario 1: Offensive role - (assault support with the infantry) - MPWS would be used with the infantry in offensive operations. A red/blue force ratio of 1:4 and a Northern NATO environment are established as the base for the determination of relative capability requirements in this scenario.

3.2.2 <u>Scenario 2: Defensive role - (blocking position)</u> - MPWS would be employed with helicopterborne forces to establish blocking positions. Friendly tanks are not available. The mission calls for delaying the enemy and channelizing his avenues of approach. It is assumed that enemy forces are mechanized to include T62, T64, and T72 tanks, BMP, BTR, assault guns, SP Artillery, and attack helicopters. MPWS will be operating at altitudes higher than sea level. A red/ blue force ratio of 4:1 in a Middle East environment is established as the base in this scenario.

3.2.3 <u>Scenario 3: Subsequent operations</u> - MPWS would be employed with a combined arms task force and would no longer be in an amphibious assault role. Blue forces are task organized, and there would most likely be low-mid intensity non-nuclear conflict. Red/blue force ratio of 1:4 and a Middle East/Third World environment are the requirements determination base.

3.3 <u>Absolute Performance Requirements</u>

The following physical design characteristics are considered to be non-negotiable and are to be treated as absolute requirements:

(1) MPWS must be transportable by the CH-53E helicopter.

(2) MPWS must be strategically and tactically air transportable. It must be capable of being transported by C130, C141 and C5A aircraft.

(3) MPWS must have amphibious shipping compatibility and will be compatible with marine salt water environment.

(4) MPWS must have at least a fording capability.

(5) MPWS must have an N-B-C defense over-pressure capability and the design must be compatible with established decontamination procedures.

(6) MPWS must accommodate ancillary capabilities designated as required (see Table 3-1).

3.4 MPWS Performance Structure

The basic considerations that describe the mission needs for MPWS are displayed in the tree structure for MPWS (Figure 3-1). This structure provides an overview of these considerations and in no way reflects their relative importance.

3.4.1 Variable performance parameters for operational effectiveness -

3.4.1.1 Utility curves - Figure 3-1 portrays the many operational effectiveness variable performance parameters whose utility for improvement were quantified for guidance by the USMC Committee. Inherent in these utility curves for the many performance parameters is the notion that design trade-offs are acceptable within the 0-to-100 range of utility; that is, MPWS performance in some area can be sacrificed to the point of zero marginal utility in order to achieve performance gains in other areas. The zero utility point on each performance parameter does not mean that a system with this capability has no utility to the Marine Corps. Rather, it means that this level of performance is the minimum acceptable to the Marine Corps across its range of missions. Increased performance for each parameter has value to the Marine Corps as shown by the shape of the utility curves. (Sample curve is in Figure 3-2.) The shapes of these utility curves are the same for all of

Required Capability	Desired Capability	Priority*
NBC	NBC	
Warning	Fresh Water	M
Protection	Human Waste Disposal	L
Overpressure	Rations Warmer	L
Collective		
Individual		
Decontamination		
Electronics	Electronics	
Secure Voice	Ground Navigation System	H
Intercom	PLRS (Position location reporting system)	H
Receiver/Transmitter & Receiver	BIFF (Battlefield Identification Friend or Foe)	M
	Laser Designator	M
	Laser Detector	M
Other	Other	
Automatic Fire Detection & Suppression System	Applique Armor	M
Driver Night Vision	Cooling (Personnel)	M
Smoke	Aux. Power Unit	M
Generator	STE/ICE (Self-test Equipment/ Internal Combustion Engine)	H
Grenade	Self Recovery	M
Personnel Heater		
Arctic/Desert Capability		
Slave Capability		
On-Vehicle equipment		

* Priority of desired capabilities

L - Low
M - Medium
H - High

Table 3-1

LIST OF PRIMARY ANCILLARY CAPABILITIES

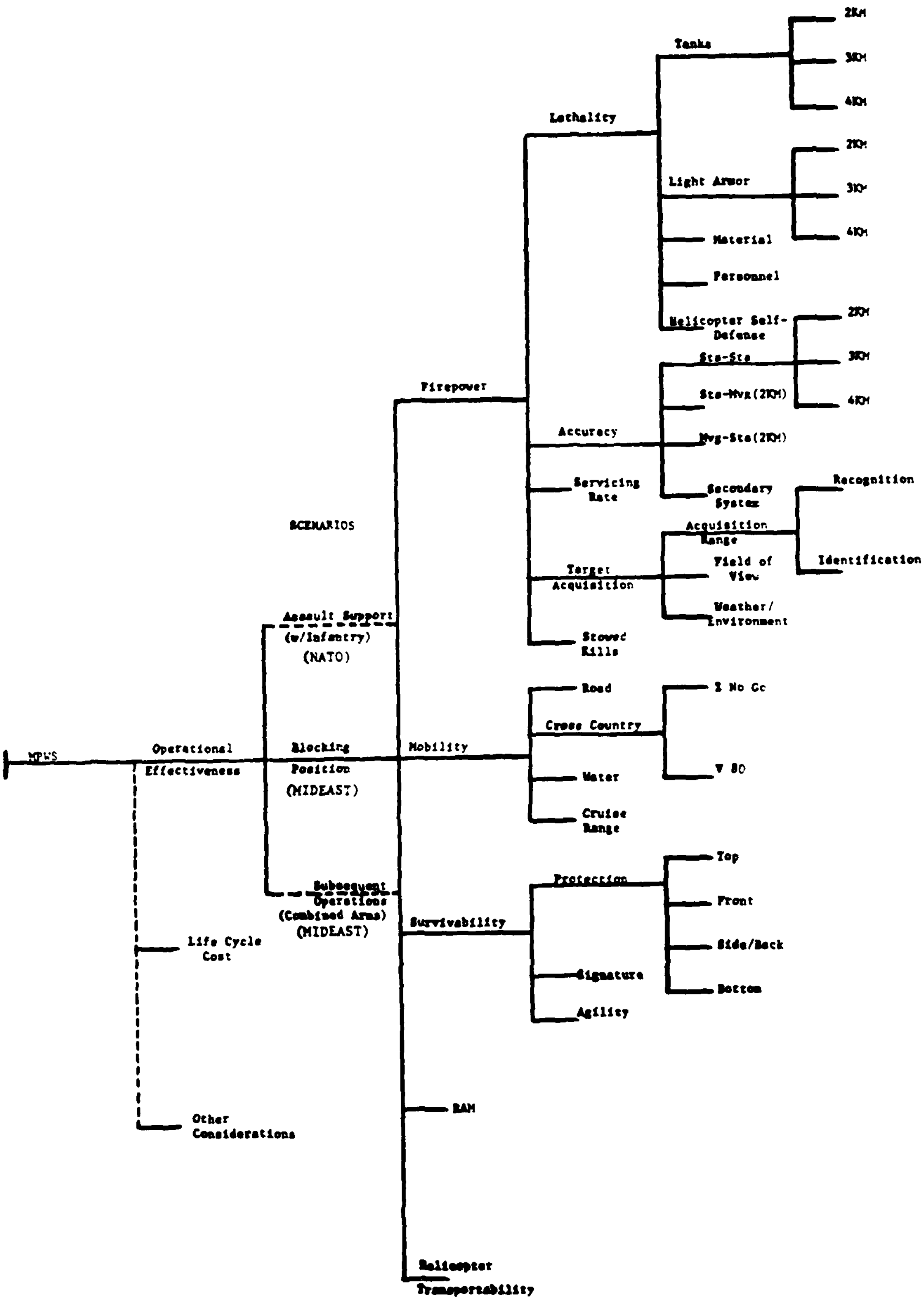


Figure 3-1

COMPONENTS FOR DESIGN CONSIDERATION

the above scenarios. However, the relative importance of improvements in one parameter compared to improvements in another parameter do vary across the three scenarios. These relative importances of performance parameter improvements are described in the next section, Weights. Appendix A defines the parameters in Figure 3-1 and describes the utility curves for each parameter.

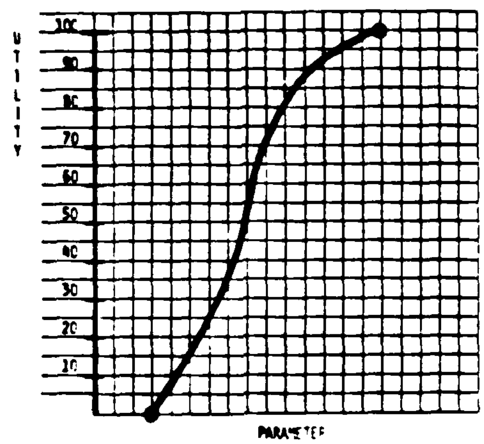


Figure 3-2

SAMPLE UTILITY CURVE

3.4.1.2 Weights - Improvements in performance determined from the curves for each parameter are not equally important in the overall analysis of an MPWS. Therefore, a weighting procedure is applied to the scores to allow relative comparisons. The meaning of the weights can be described as follows: the weight given to parameter A reflects how much more important it is to improve from a score of 0 to 100 in parameter A as compared to the same improvement in parameter B. For MPWS, weights play a large role in distinguishing between scenarios. While the shapes of utility curves remain constant across scenarios, their relative importance may change significantly. For example, an improvement in utility for helicopter transportability may be very important in the blocking position role since the MPWS might have to be lifted into position. This same improvement could be far less important in the subsequent operations role since the amphibious assault phase would be complete. Therefore, the weight that helicopter transportability has, relative to other operational effectiveness factors, would be greater in the former role than in the latter.

The weights and rationale for all parameters as a function of scenario are shown in Appendix C.

3.4.1.3 Use of utility curves and weights - Utility curves and weights can be used as follows: the abscissa (x-axis) of each curve is a measurable attribute that provides input to the curve. The ordinate (y-axis) is a measure of relative utility ranging from 0 to 100. As an example, utility curves for V80 and Percent No-Go are shown in Figures 3-3 and 3-4. Note that an improvement in V-80 from 10 to 15 mph is valued as highly as a gain from 15 to 25 mph. Both improvements would net 50 utility points. Using these curves, a candidate propulsion system yielding a V80 speed of 15 mph would receive 50 utility points while one with a V80 speed of 20 mph would receive 80 points; a candidate with 6% No-Go scores 85 while one with 16% scores 35.

These utility scores would not be very meaningful for comparing systems without a relative measure of importance between attributes. Thus, a weighting procedure is applied to the scores to allow evaluation based upon a combination of parameters. Again, consider the utility curves illustrated in Figures 3-3 and 3-4: suppose propulsion system 1 yields a V80 speed of 15 mph and Percent No-Go of 6% while propulsion system 2 had values of 20 mph and 16%. System 1 scores would be 50 and 85, while system 2

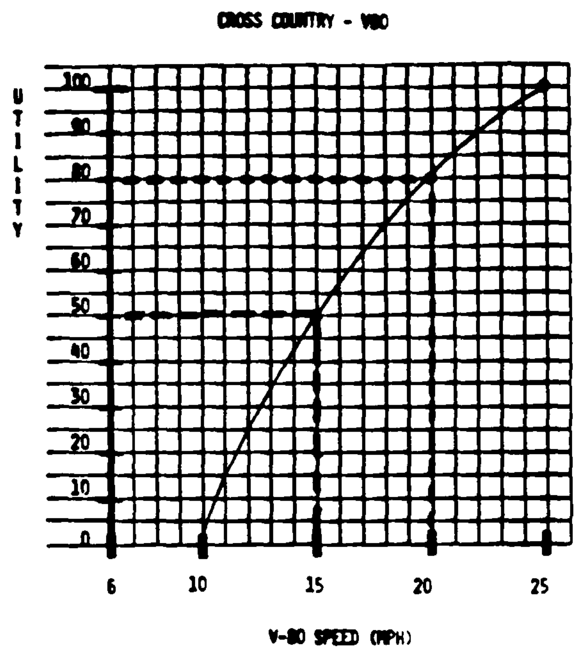


Figure 3-3

UTILITY CURVE FOR CROSS COUNTRY - V80

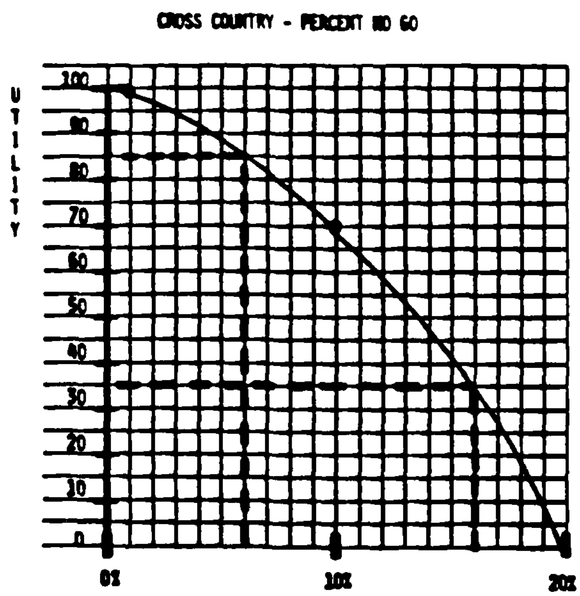


Figure 3-4

UTILITY CURVE FOR CROSS COUNTRY - PERCENT NO GO scores would be 80 and 35. If both V80 and Percent No-Go were equally important, we could say that weighted scores for both systems would be:

System 1: 1/2 (50) + 1/2 (85) = 67.5
System 2: 1/2 (80) + 1/2 (35) = 57.5.

This would indicate that propulsion system 1 was superior on these factors. However, if V80 was considered to be two times as important as Percent No-Go, weighted scores would be:

System 1: 2/3 (50) + 1/3 (85) = 61.7
System 2: 2/3 (80) + 1/3 (35) = 65.

In this case, propulsion system 2 would be better.

It should be clear that the relative importance weights play a major role in the design and evaluation processes.

3.4.2 Life-cycle costs - Components of Life-Cycle Costs (LCC) are described in Supplement H to the MPWS Statement of Work (Life-Cycle Cost Guidance). The utility curve for LCC is found in Appendix B.

3.4.3 Other considerations - While not treated as absolute constraints, the following caveats are to be given serious consideration in design:

(1) Growth potential is desirable in the form of variant vehicles. The feasibility of the design should be adaptable to variant missions, (e.g., APC, command vehicles, recovery vehicles).

(2) Ancillary capabilities have been identified as required or desired in Table 3-1. Capabilities identified as required are considered mandatory.

(3) Crew size will be treated as a variable for design and will be evaluated on its impact on life-cycle costs, systems capability, and skill structure required for operations.

APPENDIX 1 TO THREAT AND REQUIREMENTS STATEMENT

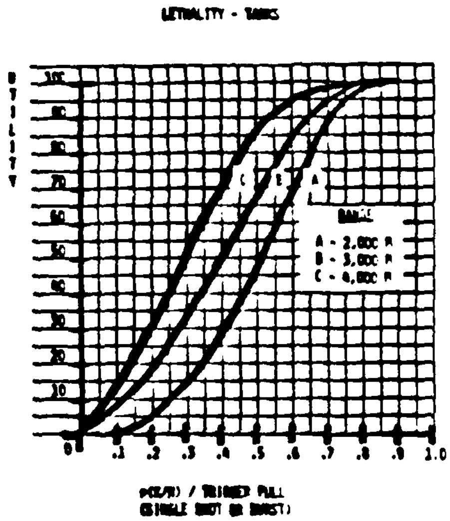
UTILITY CURVES AND RATIONALE
FOR VARIABLE PERFORMANCE PARAMETERS:
OPERATIONAL EFFECTIVENESS

OPERATIONAL EFFECTIVENESS

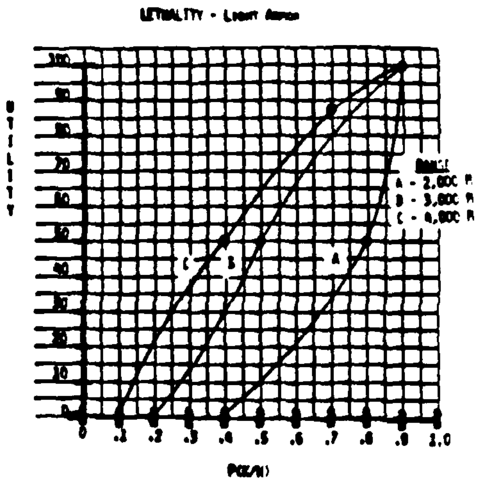
A. Firepower considerations include lethality, accuracy, target acquisition, servicing rate and stowed kills.

(1) Lethality is measured in terms of probability of a kill given a hit, or p(K/H). Lethality is considered against tanks, light armor, materiel, personnel, and helicopters. In all cases, this lethality can be achieved with any weapon system on board the MPWS (gun, missile, or other).

(a) Lethality against tanks considers the T72 tank as the worst case target. A kill can be either a mobility or a firepower kill (M or F kill) which requires more than 24 hours to repair. Probabilities for P(K/H) assume a cardioid distribution and single shot or burst per trigger pull. 2Km is the most likely range, but better standoff is preferred (4KM). At 4KM, P(K/H) is terrain limited rather than vehicle limited.

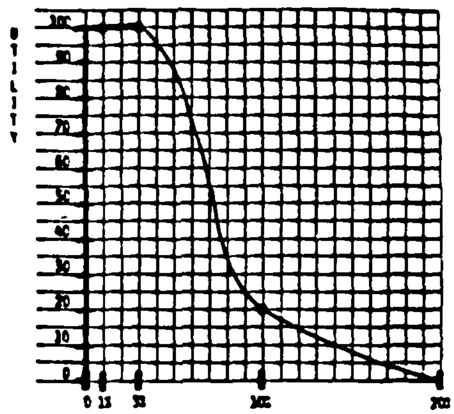


(b) Lethality against light armor - A high probability of kill given hit is important to eliminate the light armor threat. This will enable other anti-tank weapon systems to concentrate on tanks. A kill can be either a mobility or a firepower kill (M or F kill) which require more than 24 hours to repair. BMP is the expected target; cardioid distribution is used; BMP threat is severe at 2KM and more limited at 4KM; therefore, the curve for 2KM rises very steeply at higher probabilities. MPWS must achieve P(K/H) of .4 at 2KM, .2 at 3KM, and .1 at 4KM or it has little value.



(c) <u>Lethality against materiel targets</u> - materiel targets can include 8" reinforced (horizontal and vertical) concrete at 3000PSI strength; 16' X 12' wall; bunkers can include 6" X 6" bolted, 2' sand on roof, 4' enclosure, 7' sand (outside to 1st timber), 18" bunker and sand above ground. Bunkers and bunker type targets are important in infantry support in places in which tanks have difficulty trafficking (for safety or other reasons), such as MOBA. Bunkers are the most demanding target in MOBA. The utility is a function of the percent of basic load required to achieve a catastrophic kill (render unusable) at 2KM. Utility drops very rapidly if it takes more than 3% of the basic load, and not much utility is gained if more than 10% is required. If the percent of load is high, MPWS will need to resupply too frequently.

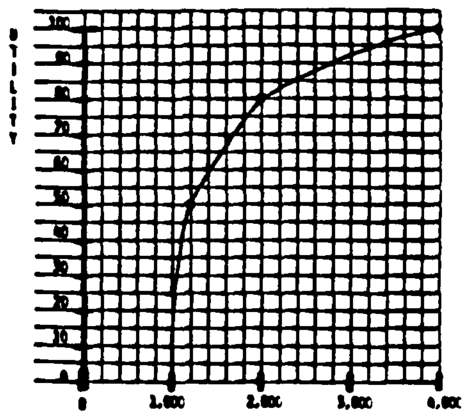
MATERIEL TARGET



PERCENT OF BASIC LOAD REQUIRED TO CATASTROPHICALLY KILL A MATERIEL TARGET AT 2,000 M

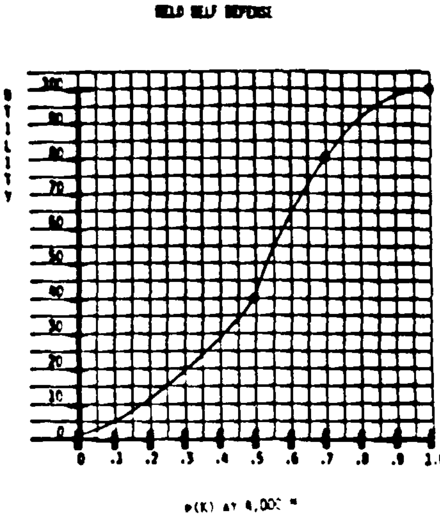
(d) <u>Lethality against personnel targets</u> - The measure of effectiveness here is the ability to kill or supress personnel with a probability of .8 as a function of range. Most of the benefit is gained at a range of 1000 to 1500 meters with 80% of the utility achieved by 2000 meters.

PERSONNEL TARGETS



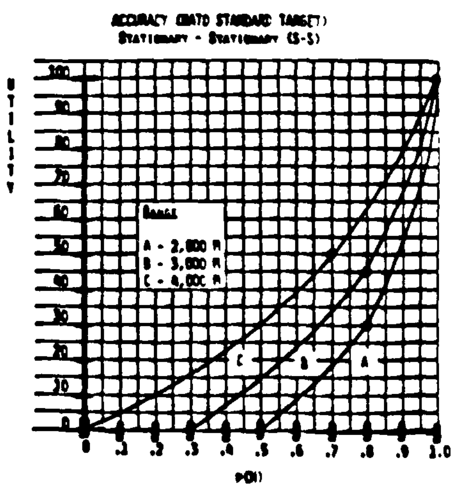
RANGE (M)

(e) Lethality against helicopters - The curves assume a hovering helicopter has been acquired at a 4000 meter standoff range, and MPWS is stationary. Lethality includes kill or suppression. In this case, probability of kill equals probability of hit. The curve starts to rise more rapidly if P(K) of at least .5 is achieved.

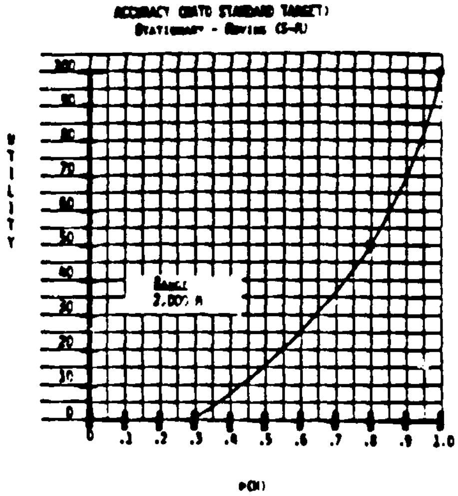


(2) Accuracy - The measure of accuracy is probability of hit, P(H). The utility curves assume a standard NATO target at a specified range. The probability of hit includes the probability of acquisition with fire control, but assumes detection, recognition, and identification have occurred. Stationary MPWS firing at a stationary target evaluates the main gun and sight; stationary MPWS firing at a moving target adds the fire control system, and moving MPWS firing at a stationary target adds the stabilization system. There is no need to examine a moving MPWS firing at a moving target since all systems have been considered in the above combinations. Integration of these systems must occur after concept definition and is expected to be feasible.

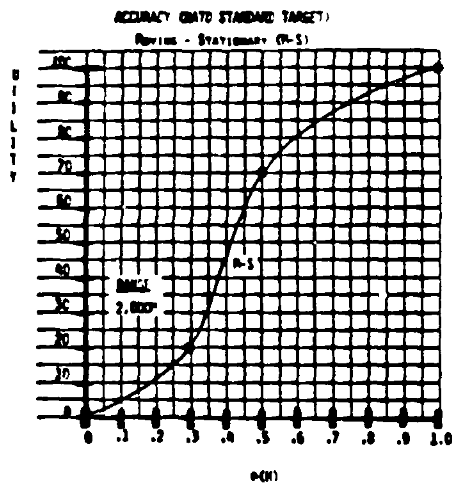
(a) Stationary MPWS - Stationary target - At least half of the utility comes from achieving improvements beyond P(H) = .7. At 2000 meters, if P(H) is less than .5, MPWS has no value since the crew would not want to give away their position unless there was a good chance of hitting. At 4000 meters, low scores for accuracy are primarily due to ballistic considerations. This parameter is a measure of how well the main gun and sight are performing.



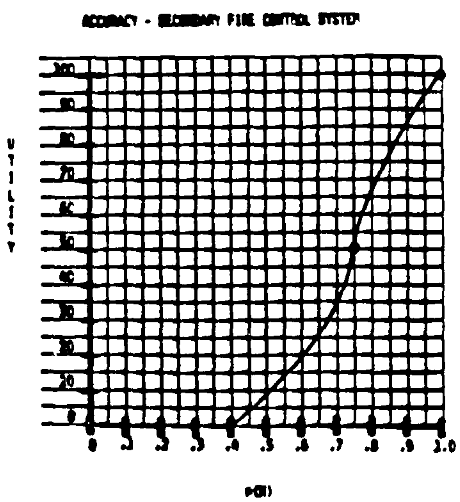
(b) <u>Stationary MPWS - Moving target</u> - A fixed range of 2000 meters was used, and the target was assumed to move at 20KM/hr. crossing speed (12.4 mph). This parameter is an indicator of how well the fire control plus main gun performs. There is no value if the MPWS cannot achieve P(H) of at least .3.



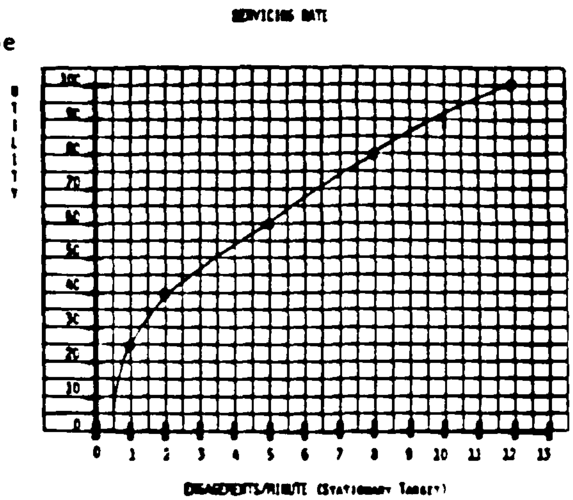
(c) <u>Moving MPWS - Stationary target</u> - This assumes that MPWS is moving at 20KM/hr. (12.4 mph) and line of sight is constant. A range of 2000m is assumed. A large increase in utility occurs if P(H) can be pushed beyond .3.



(d) <u>Accuracy of the secondary fire control system</u> - The utility curve assumes line of sight, perfect environment, and a stationary target at 2000 meters. The secondary system can be less accurate than the primary system but still must achieve P(H) = .4 to have any value.

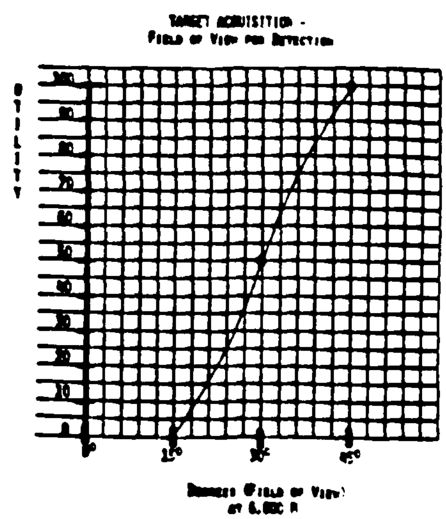


(3) Servicing Rate - The utility is a function of the number of engagements/minute against a stationary target at 2000 meters. It is based upon aimed fire and is determined from trigger pull to trigger pull. Since missiles can be considered which have a relatively low servicing rate, considerable utility is gained even as low as two engagements per minute.

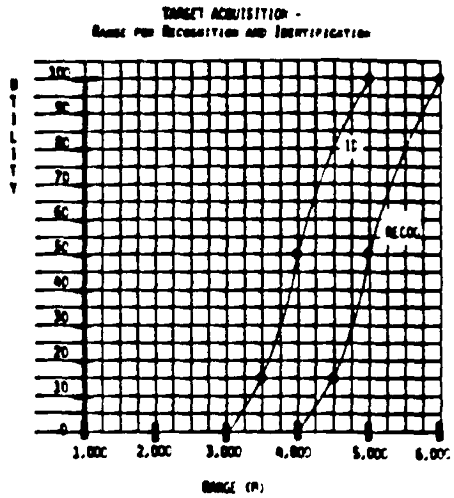


(4) Target Acquisition - This includes detection (realizing that a target exists), recognition (determining the type of target), and identification (friend or foe). Acquisition time includes selection of ammunition but is not represented by a separate utility curve. Field of view, acquisition range, and capabilities in different weather/environmental conditions are considered.

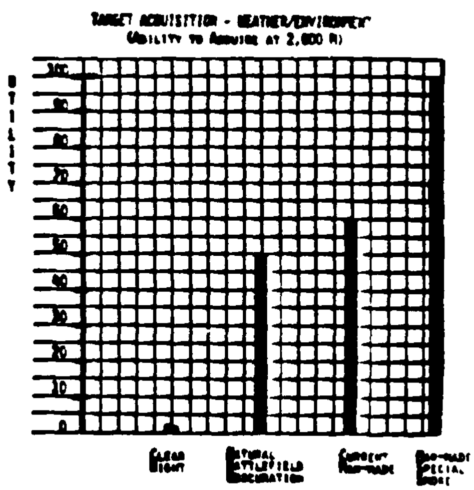
(a) Field of view for detection - This is measured at 6000 meters and is expressed in terms of degrees field of view. Daytime conditions are assumed. 15° is the minimal field of view considered adequate.



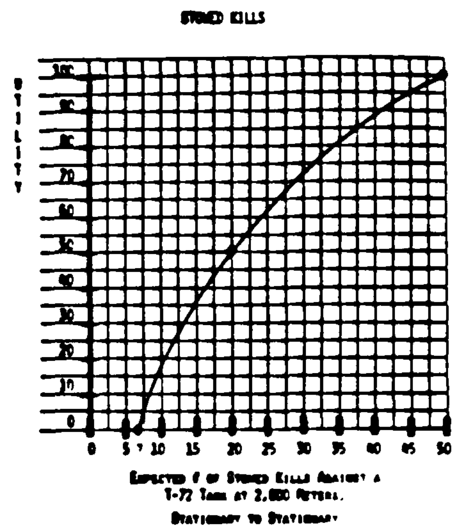
(b) <u>Acquisition ranges for recognition and identification</u> - The utility curves assume line of sight, a narrow field of view, and perfect climatic conditions. Range is defined as the range at which a main battle tank can be recognized and identified. Recognition often occurs at approximately 1000 meters before identification.



(c) <u>Weather/environment</u> - The utility structure measures value as a function of weather/environment considerations. Night conditions are determined by ambient light. Assume thermal signature is degraded by smoke, dust, and rain. This parameter is a measure of the ability to acquire (detect, recognize, identify) at 2000 meters. While the utility is measured at discrete conditions, there can be many deviations around those points that might be appropriate.

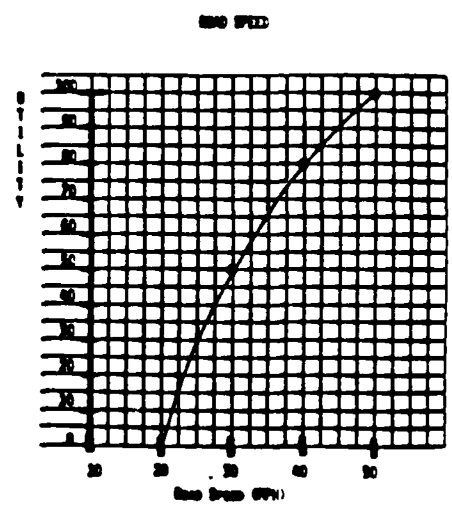


(5) Stowed Kills - This parameter is defined as the expected number of stowed kills against a T-72 tank at 2000 meters (firing stationary to stationary). A cardioid distribution is assumed. Stowed kills are a function of ammunition carrying capacity, probability of a hit P(H), and probability of a kill given a hit P(K/H). Since P(H) and P(K/H) have already been considered, the primary value associated with this utility curve is the ammunition capacity. Seven stowed kills is the minimum. Fifty stowed kills can be achieved with a basic load of 80 and a P(K) of .63.



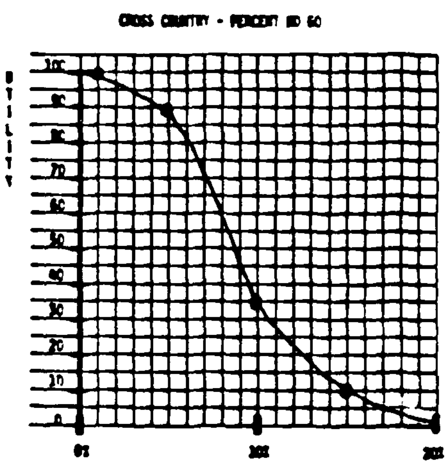
B. Mobility - This includes road and cross country mobility, water crossing, and cruising range.

(1) Road Mobility - The utility curve is a function of speed on dry level roads. A speed of less than 30 mph would require other vehicles to wait for MPWS. At 40 mph, vehicles could stay together. A speed of 50 mph might be needed to maneuver for reinforcing. Very high speeds could result in unused capability since other vehicles could not keep up with MPWS.

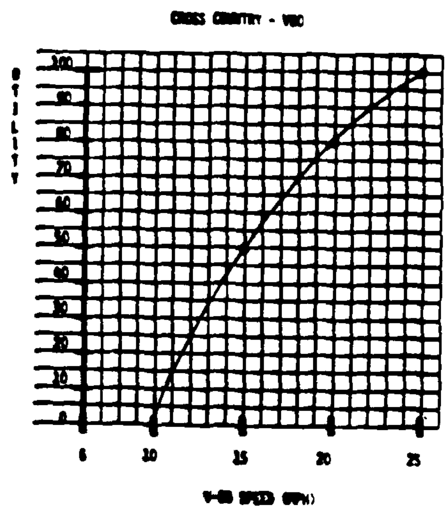


(2) Cross-country Mobility - This will be evaluated using the Army Mobility Model. A Northern Germany terrain model was considered because it has many terrain and weather characteristics representative of other areas.

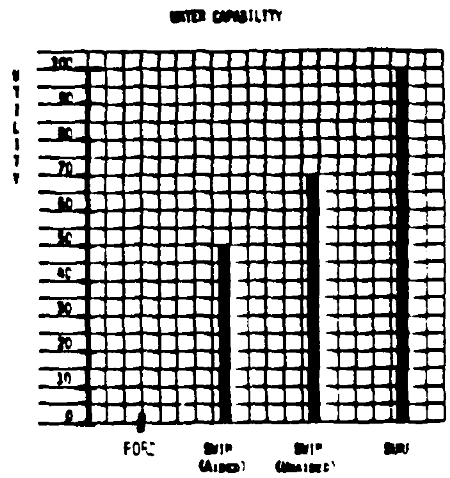
(a) % no-go - This utility curve represents the percent of terrain that a vehicle cannot negotiate. It considers ground pressure, trench crossing, vertical obstacles, and gradients. In evaluating systems, wet earth and Germany conditions should be assumed. 2% no-go is the ability of the IFV while 4% no-go is that of the XM-1. 20% no-go brings in 4-wheel drive vehicles. Anything worse than 20% is not of much value.



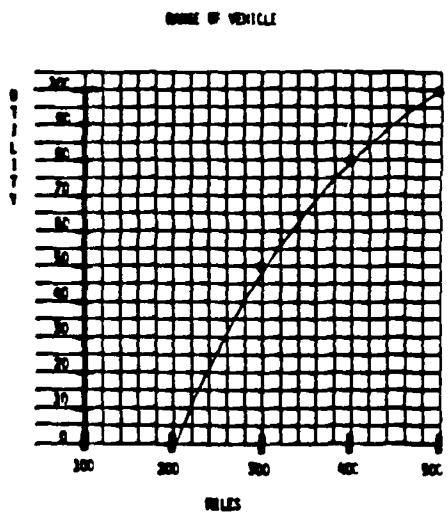
(b) V-80 speed - This represents the velocity over the best 80% of the terrain. This corresponds to a % no-go of 20% being unacceptable. Anything less than 10 mph is of no value, and most of the utility is achieved if a V-80 of 20 mph can be reached.



(3) <u>Water Capability</u> - Most water obstacles are fordable; therefore, swim capability may not be essential. Tanks cannot swim, so if MPWS operates with tanks, swim capability is not necessarily critical. Aided swim means that the vehicle cannot displace sufficient water to float without adding flotation devices.



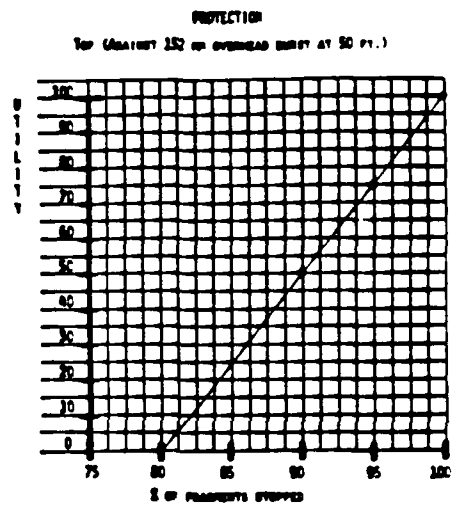
(4) <u>Cruising Range</u> - This is primarily a function of fuel capacity and consumption. Most existing tactical vehicles can achieve at least 300 miles cruising range; therefore, 300 miles falls midway on the utility scale. The M60 tank achieves approximately 310 miles.



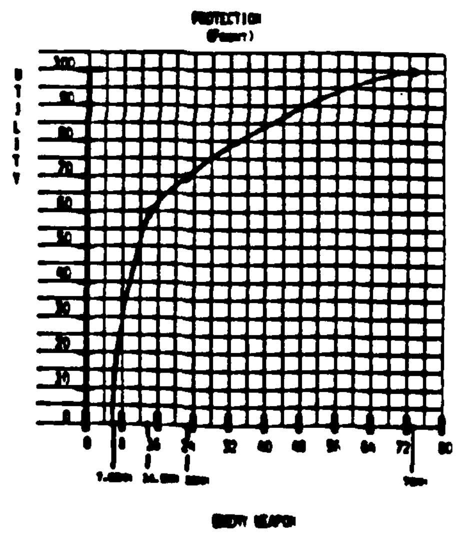
C. <u>Survivability</u> - This considers the ability to survive enemy attack. It includes protection from weapons, visual signature, and agility.

(1) <u>Protection</u> - includes protection from any side or angle.

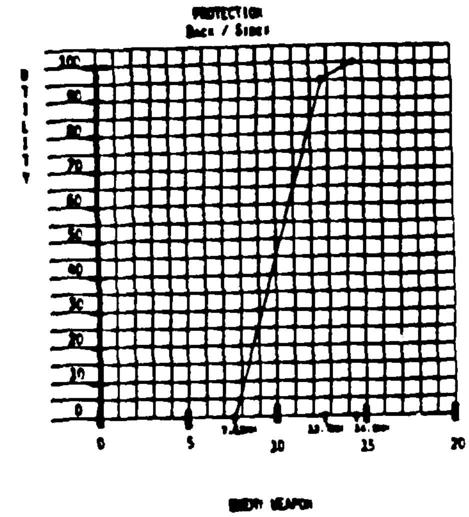
(a) <u>Top</u> - The utility curve considers protection from overhead bursts at 50 feet from the equivalent of 152 mm rounds (Soviet Artillery). Utility is a function of the percent of fragments that are stopped by the armor. 80% is the minimal level of acceptance for protection.



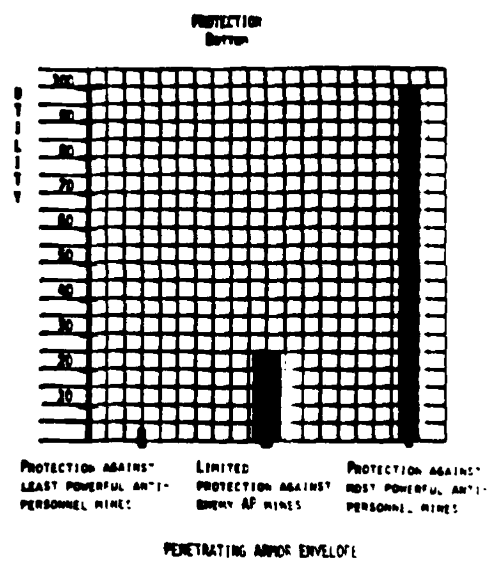
(b) <u>Front</u> - Frontal protection assumes that the projectile has 0° horizontal obliquity. For the 7.62 mm round, assume point blank range. If the armor cannot stop 7.62 mm, it has no value. The capability to stop 14.5 mm rounds is a great increase in utility since the enemy has many such machine guns and the round is armor piercing. There is not much gain in increasing capability to stop 23 mm guns since the enemy has relatively few. The 73 mm projectile is a HEAT round.



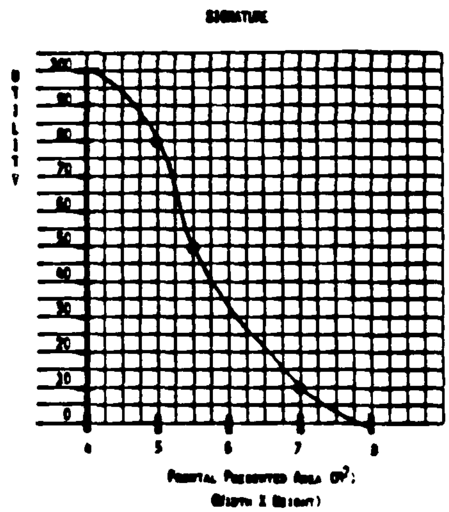
(c) Side/back - The 7.62 mm is easy to defend against, but the 12.7 mm poses a major threat. Therefore, a large jump in utility is achieved. It would be extremely costly to defend against the 14.5 mm weapon.



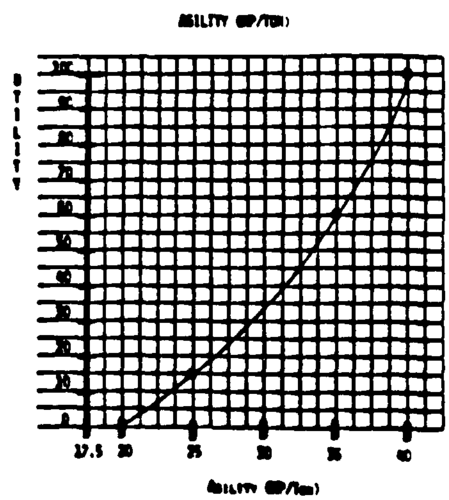
(d) Bottom - Antitank and antipersonnel mines are major threats. Defense against antitank is not considered to be achievable. Protection means preventing penetration of the armor envelope. A large range exists between the discrete points specified in the graph.



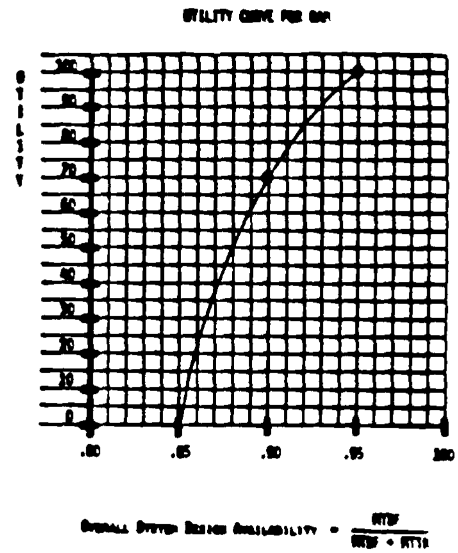
(2) Signature - Signature is the characteristic that enables a vehicle to be identified by the enemy. Visual signature is stated in terms of frontal presented area. (Audio, electromagnetic, and thermal signature are not considered here.) The utility curve assumes that the vehicle is fully exposed and not in hull defilade. The frontal presented area of a BMP is 4.72 sq. meters. Typically, the ratio of frontal presented area to side presented area is relatively constant across existing light armored vehicles; therefore, only frontal presented area will be used for evaluation.



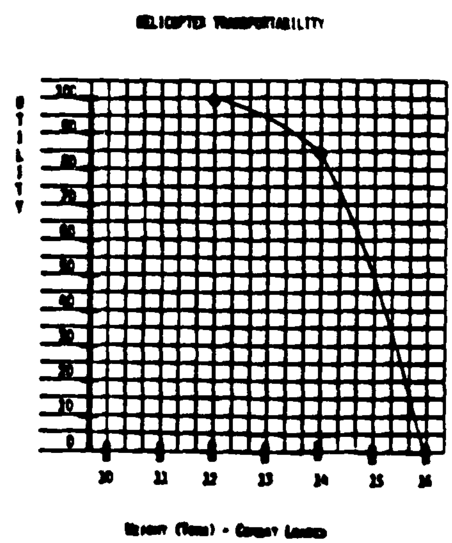
(3) Agility - This is defined in terms of horsepower/ton ratio. Little value accrues until 25 HP/ton is achieved. Anything above 35 HP/ton is excellent because it provides acceleration necessary for enhanced survivability. Agility for the XM-1 tank is 23 HP/ton.



D. Reliability, Availability, & Maintainability - (RAM) - The utility curve focuses upon design availability. Both scheduled and unscheduled maintenance are considered. Any maintenance incident which degrades mission performance, causes mission termination, or creates a safety hazard constitutes a chargeable failure. Mean-time-between-failures (MTBF) is a measure of reliability. Mean-time-to-repair (MTTR) is a measure of maintainability and is defined as that portion of the total unscheduled maintenance time expended to correct chargeable system failures divided by the total number of chargeable system failures. Overall system design availability is measured as MTBF $\div$ (MTBF + MTTR). This utility curve is a function of this ratio. Durability, normally included with RAM, is not considered here but is treated as part of life-cycle-cost.



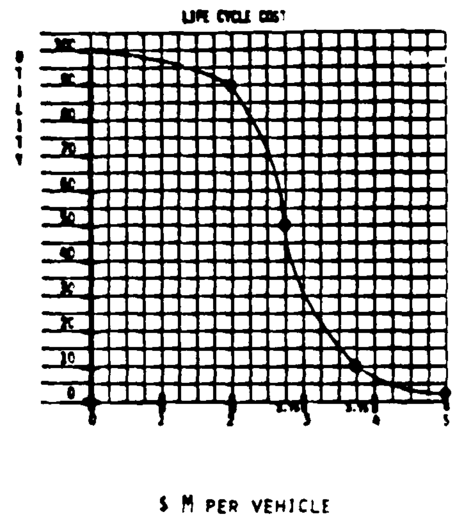
E. Helicopter Transportability - 90% of the USMC operational "world" is described as having an altitude of 3000 feet and temperature of 91.5° F, and, therefore, a 12-ton lift weight is outstanding. The intratheater lift needs are harder to meet than beach assault lift needs. Consequently, operating at higher altitudes is a limiting constraint. 12 ton = 100% utility under conditions described above. 14 ton = slightly less (gives capability in approximately 85% of "Marine Corps World"). 16 ton is still the point beyond which there is no utility. The utility curve depicts capability represented by 12, 14, & 16 ton lift. This data is HIGE (Hover in Ground Effect--the intended mode of use for the CH-53E).



APPENDIX 2 TO THREAT AND REQUIREMENTS STATEMENT

UTILITY CURVE AND RATIONALE
FOR LIFE CYCLE COSTS

Life Cycle Costs (LCC) - This utility curve considers costs of development, procurement (to include spares), PWR ammunition, Training Ammo, and O&M (to include direct and indirect personnel and support cost). Research and development funds are not included. It is based upon a twelve-year life cycle, assuming 400 vehicles. 1981 dollars are used for LCC calculations. Further life cycle cost guidance is found in supplement H to the MPWS Statement of Work. Utility drops rapidly if LCC is more than $2M per vehicle. LCC of over 3.75M are considered excessive.



APPENDIX 3 TO THREAT AND REQUIREMENTS STATEMENT

RATIONALE FOR WEIGHTS

RELATIVE IMPORTANCE: OPERATIONAL EFFECTIVENESS				
OPERATIONAL EFFECTIVENESS	ASSAULT SUPPORT	BLOCKING POSITION	SUBSEQUENT OPERATIONS	RANGE
FIREPOWER	34	29	29	29-34%
MOBILITY	20	17	24	17-24%
SURVIVABILITY	19	20	24	19-24%
RAM	10	13	17	10-17%
HELO TRANSPORTABILITY	17	20	6	6-20%

Assault Support - Firepower is the most important parameter. It is significantly greater than other parameters because the threat is the most difficult in assault support roles. Mobility and survivability are very close in importance, and are important since MPWS must move with the infantry. RAM, although important, is relatively the least important since disabled vehicles remain behind friendly lines and have access to higher echelon repair. Firepower was felt to be twice as important as helicopter transportability.

Blocking Position - Firepower is again most important, but on a relative basis, survivability and helicopter transportability carry greater weight in a defensive scenario than in an offensive one. The utility of the MPWS is enhanced in that it can be helicopter lifted into blocking positions at varying altitudes. Survivability is higher since enemy attacks are normally preceded by heavy artillery, and MPWS will be moving to alternate positions frequently. RAM is low because it is less likely for power train failure in the defense, but it is relatively more important since disabled vehicles must be left in the path of oncoming enemy forces.

Subsequent Operations - Firepower remains most important, but the MPWS is not optimized for duels with tanks. Mobility and survivability increase greatly in relative importance. Blue forces are task-organized and no longer in an amphibious assault phase, so helicopter transportability is not critical. Movement with a MCATF dictates high emphasis on mobility.

RELATIVE IMPORTANCE: FIREPOWER				
FIREPOWER	ASSAULT SUPPORT	BLOCKING POSITION	SUBSEQUENT OPERATIONS	RANGE
LETHALITY	15	17	17	15-17%
ACCURACY	30	26	24	24-30%
SERVICING RATE	6	18	18	6-18%
TARGET ACQUISITION	28	19	22	19-28%
STOWED KILLS	20	21	19	19-21%

Assault Support - Accuracy and target acquisition carry the greatest weights because the ability to fight on a dirty battlefield is critical. An increase in stowed kills would be very meaningful, while an increase in servicing rate is less critical in the assault.

Blocking Position - Servicing rate becomes a far more important factor since the enemy has a 4:1 force ratio advantage. Accuracy remains the most important factor, but the other parameters are very close in relative worth. Target acquisition is less important in this role because avenues of approach are better defined. The scenario is a good environment for resupply and some prepositioning of ammo is possible. Target rich environment demands constant fire.

Subsequent Operations - Accuracy still is most critical, but other factors all carry considerable weight. Target acquisition is important since the battlefield is extremely dynamic.

RELATIVE IMPORTANCE: FIREPOWER/LETHALITY				
LETHALITY	ASSAULT SUPPORT	BLOCKING POSITION	SUBSEQUENT OPERATIONS	RANGE
TANKS	24	38	31	24-38%
LIGHT ARMOR	29	38	34	29-38%
MATERIEL	34	6	10	6-34%
PERSONNEL	10	8	12	8-12%
HELO SELF-DEFENSE	3	11	14	3-14%

Assault Support - There will be a high-intensity role against materiel (bunkers) in the assault, and materiel targets can provide real impedance to progress. MPWS's best capability is against light armor and light armor is the highest density target. MPWS is not primarily an antitank weapon. Personnel targets can be engaged by secondary armaments and thus carry low weight. Helicopter self-defense is a last resort role, since blue should have air superiority in the assault.

Blocking Position - The opposing force will probably initially be tank heavy with high density of light armor. Blue expects three times as many light armor targets as tank targets. Personnel are a minor threat, and bunkers are not very important as targets in a defensive role. Since the enemy may have air superiority, the helicopter threat is now greater.

Subsequent Operations - Light armor will be a very high density threat. Heavy enemy helicopter attacks can be expected. There is also a reasonable threat from materiel and personnel targets.

RELATIVE IMPORTANCE: FIREPOWER/ACCURACY				
ACCURACY	ASSAULT SUPPORT	BLOCKING POSITION	SUBSEQUENT OPERATIONS	RANGE
STATIONARY TO STATIONARY	53	35	27	27-53%
STATIONARY TO MOVING	26	43	29	26-43%
MOVING TO STATIONARY	16	15	36	15-36%
SECONDARY FIRE CONTROL	5	7	9	5-9%

Assault Support - In the offense the materiel targets carry greatest weight and they are stationary. Also, while moving with infantry, there will be more time to shoot stationary to stationary. The secondary fire control system only becomes important if the main sight is out.

Blocking Position - The primary threat is a moving, attacking force. Although blue forces will be moving to alternate positions, not much shooting on the move should occur.

Subsequent Operations - In attacking with a MCATF, there will be much more emphasis on shooting on the move. However, the other shooting postures remain very important and carry a high weight.

RELATIVE WEIGHTS: FIREPOWER/TARGET ACQUISITION				
TARGET ACQUISITION	ASSAULT SUPPORT	BLOCKING POSITION	SUBSEQUENT OPERATIONS	RANGE
RECOGNITION RANGE	4	12	6	4-12%
IDENTIFICATION RANGE	7	18	10	7-18%
FIELD OF VIEW	33	20	32	20-33%
WEATHER/ENVIRONMENT	56	50	53	50-56%

Assault Support - Gaining the ability to fight in smoke is most important. Increased all weather capability is of more value than improvements in field of view and acquisition range combined. Increased field of view adds more to capability than improved acquisition range, especially if fighting in a "buttoned-up" configuration.

Blocking Position - Smoke and weather are still critical limitations. It is important to have a 24-hour, all weather capability. Avenues of approach are more restricted, therefore an increased field of view is less important than in the assault. In a blocking role, since the enemy has force superiority, it is important to identify targets at an increased range.

Subsequent Operations - Considerations are similar to those for assault support, and relative weights are very close. Identification range is slightly more important since there will be a higher density of vehicles operating on the battlefield.

RELATIVE IMPORTANCE: MOBILITY				
MOBILITY	ASSAULT SUPPORT	BLOCKING POSITION	SUBSEQUENT OPERATIONS	RANGE
ROAD SPEED	18	22	20	18-22%
CROSS COUNTRY % NO GO	36	26	21	21-36%
CROSS COUNTRY V80	18	23	19	18-23%
WATER	12	5	12	5-12%
CRUISING RANGE	15	24	28	15-28%

Assault Support - Most travel will be cross-country and will be most severely limited by terrain that cannot be negotiated. It is important not to get stuck in difficult terrain. Speed on and off the roads is less important since MPWS should not outpace the infantry. Cruising range is less important than in other roles since the enemy is basically fixed.

Blocking Position - Cross-country mobility is needed to establish blocking positions. MPWS can be positioned forward and can fight its way back to blocking position over preplanned routes, while preplanning will allow travel on roads or trails. Water obstacles are less likely to be found. Since the enemy has a 4:1 force advantage, MPWS must have sufficient cruising range to conduct retrograde operations where endurance and movement are required.

Subsequent Operations - MPWS must be able to keep distance with other members of the combined arms team. Both road and cross-country conditions will be encountered as well as water obstacles. No greater water capability is needed than is needed for the tanks. Cross-country mobility and cruising range are important since MPWS is chasing the enemy. The overwatch force must be able to keep up with the moving force.

RELATIVE IMPORTANCE: SURVIVABILITY				
SURVIVABILITY	ASSAULT SUPPORT	BLOCKING POSITION	SUBSEQUENT OPERATIONS	RANGE
PROTECTION	51	52	38	38-52%
SIGNATURE	18	16	19	16-19%
AGILITY	31	32	43	31-43%

Assault Support - Protection is the most critical survivability issue and has the most room for improvement. Agility is necessary for survival in dash for cover, other hit avoidance movements, and utilization of terrain. Visual signature is primarily important when MPWS is stationary.

Blocking Position - Protection is most critical. Signature can be more easily reduced by terrain in this role. Agility is important since there will be rapid movement to alternate positions.

Subsequent Operations - Improvements in agility can have the greatest impact when operating as part of a combined arms team.

RELATIVE IMPORTANCE: SURVIVABILITY/PROTECTION				
PROTECTION	ASSAULT SUPPORT	BLOCKING POSITION	SUBSEQUENT OPERATIONS	RANGE
TOP	51	57	40	40-57%
FRONT	15	17	28	15-28%
SIDE/BACK	13	14	18	13-18%
BOTTOM	21	11	14	11-21%

Assault Support - The greatest threat comes from enemy artillery. Antitank and antipersonnel mines can be expected as blue assaults.

Blocking Position - The threat of mines is significant only when moving to position; artillery is still the greatest concern. The attacking force will primarily be shooting at the MPWS front, but there is only a limited range of improvement against small arms.

Subsequent Operations - There is less of a threat from enemy artillery; therefore, weights of front, side, back, and bottom are closer to that of top.

APPENDIX C

MINIMUM ACCEPTABLE REQUIREMENTS FOR LAV

APPENDIX C

MINIMUM ACCEPTABLE REQUIREMENTS FOR LAV

MOBILITY

Maintained speed on level, hard surface road - 50 mph

Cruising range at road march speed (30-40 mph) - 400 mi

Controlled swim speed 3 mph

Min verticle obstacle crossing 1.5 ft

Capable of negotiating 60% slope

Capable of operating on 30% side slope

Cross-country (NATO reference mobility model)

20% No-Go German dry; V(80): 8 mph
25% No-Go Mideast dry; V(80): 8 mph
30% No-Go German snow; V(80): 7 mph

Diesel engine (safety, commonality, range)

AGILITY

Acceleration of 0-20 mph in 10 seconds

Braking of 20-0 in 35 ft

PHYSICAL CHARACTERISTICS

Maximum combat loaded gross vehicle weight of 14.5 tons

Lifting eyes for CH-53E sling

Variants (all) - Common hull, frame, power train, and suspension

Strategic transportability (C-130, C-141, C-54)
Assault shipping - Move from storage deck to helicopter deck

SAFETY

Fire extinguishers for personnel and engine compartments

Alternative exit

ENVIRONMENT

Survive repeated exposure to salt water in amphibious shipping

FIREPOWER/FIRE CONTROL

LA - Automatic cannon (min 20mm) - Safety certified gun and ammo (can engage light armor, materiel, personnel, and slow moving aircraft)

LA - Elevation - Depression +60 degrees to -80 degrees

LA - P(Hit) = .4 for burst fire on 2.3m x 2.3m target at 800m

LA - Growth to 25mm Chain gun (Prototype in first year, production available in second year of buy)

Turret with 360 degrees field of view with backup elevation and traversing system

SECONDARY ARMAMENT

Automatic fire effective between 20-800mm against materiel and personnel targets

VISION

270 degrees for commander

Frontal 90 degrees for driver

Passive night driving capability

CREW SIZE/CONFIGURATION

Crew of three (LA and AG)

Turret/troop carrying capacity: 1 man turret/6 troops or

2 man turret/4 troops

SURVIVABILITY

Protection versus 7.62mm ball; .75 probability of no hull penetration from an air burst at 50 ft from 152mm arty

Other

Slave start capability; on vehicle equipment; self-recovery

RAM-D (Mil handbook explains how to develop this information)

Reliability - 1250 mean miles between mission failure (MMBMF)-- where mission length is 200 mi (confidence level of 80%). Probability of completing the 200 mi mission is .9.

Maintainability - Maintenance ratio (MR) excluding driver/crew of at most .30 at 20 mph. MTTR at the organizational level not to exceed 1.3 clock hours. Maximum time to repair is 2.6 clock hours.

Durability - 50% confidence with a .6 probability of completing 20,000 miles without overhaul or replacement of engine, transmission, transfer case, or differential. Also, 50% confidence with .6 probability of completing 20,000 miles without cracking or significant deformation of the hull, body, or frame and major supporting members.

APPENDIX D

EVALUATION CRITERIA FOR SOURCE SELECTION

APPENDIX D

EVALUATION CRITERIA FOR SOURCE SELECTION

1.1 Evaluation Criteria for Technical Performance

1.1.1 Light Assault (LA) variant -

Mobility	Requirements: Min Accept*	Requirements: Goal**
% No-Go		
German Dry	20	10
Mideast Dry	25	20
German Snow	30	20
V80 (mph)		
German Dry	8	15
Mideast Dry	8	15
German Snow	7	12
Cruising Range (miles on road march; rolling terrain)	400	600
Road Speed (mph level hard road)	50	70
Swim Capability (Controlled)		
Speed (mph)	3	6
Preparation Time (min)	5	0
Surf Capable (ft of waves)	0	3
Fuel Economy (mpg on road march)	4	10

*This is a threshold (not Min Accept) for those criteria not identified in Appendix C.

**This entry defines the 100-point on the evaluation scale.

Survivability	Requirements: Min Accept	Requirements: Goal
Agility		
Acceleration (Scores for 0→20 mph)	10	5
Braking (Feet for 20→0 mph)	35	20
Turning Radius (Feet)	60	Pivot
Protection		
Armor	7.62 Ball @0M (0°)	7.62 AP @0M 0° and 14.5 (B32) @ 100M (0°)
Signature		
Thermal (Meters for no signature, tank sight)	2000	500
Noise (Feet for 83 dB)	50	30
Visual		
Dust (Ft^2 of cloud at 2000m)	200	0
Frontal presented area (M^2)	8	4
Fire Extinguishers	Manual	Automatic (See Spec.)

Transportability	Requirements	
	Min Accept	Goal
Helicopter (Tons, Combat loaded)	14.5	10.2
Fixed Wing Aircraft		
C-130 (#)	1	2
C-141 (#)	2	3
C-54 (#)	4	7
Assault Ship (Move from storage deck to helicopter deck)		

Firepower	Requirements	
	Min Accept	Goal
p(Hit) @ 8oom for burst	.4	.8
Lethality (Penetrate vehicle @ range)	BTR @ 8oom	BMP @ 2000m
Growth to 25mm Chain Gun	Prototype in 1st yr, available in 2nd year buy	Now
Rounds		
Ready	50	125
Stowed	250	1000
Configuration	2 man turret 4 troops	2 man turret 8 troops

	Turret		Troops	
100	2 man		8	storage
90	2 man	Commander's Flexibility	6	
50	1 man		8	growth capability for 2 man turret
25	1 man		6	force structure
0	2 man		4	

Environment	Requirements Min Accept	Goal
Amphibious Shipping--survive repeated exposure		
Climatic Zones	Hot, humid Hot, dry Basic cold w/no kits	1-7
NBC Capability		
Protection	None	Collective/ Overpressure
Detection	None	Automatic

Ram-D

	Min Accept	Goal
Maintainability		
Maint. Ratio (at 20 mph)	.3	.1
MTTR (clock hours)	1.3	.75
Max time to repair (clock hours)	2.6	1.5
Commonality		
Other variant (% common parts)	60%	100%
Fielded systems (% common parts)	0%	100%
Reliability		
Automotive MMBMF (mi)	1250	1950
Turret	TBD	TBD

RAM-D (Cont'd)	Requirements	
	Min Accept	Goal
Durability		
Automotive Probability of completing 20,000 mi	.6	.9
Turret	TBD	TBD

HUMAN FACTORS/SAFETY

Storage (individual plus TO/TE gear)--ft^3	27	50 very usable
Crew Proficiency--Station Layout and Display		
Gunner	↑	
Driver		
Commander		
Squad Proficiency	to be established based upon competitive availability	
Troop Fatigue		
Vision		
Firing Ports		
Entry/Exit		
Safety		
Ventilation		
Other	↓	

HUMAN FACTORS/SAFETY (Cont'd)

	Requirements	
	Min Accept	Goal
Vision		
Field of View		
Driver	90°	120°
Commander	270°	360°
Gunner	270°	360°
Night/All weather		
Driver	Passive I^2	Thermal Imagery
Commander	None	Thermal Imagery
Gunner	Passive I^2	Thermal Imagery

1.1.2 Assault Gun (AG) variant - All thresholds and goals for the performance of AG are identical to the minimum acceptable and goals of the LA with exception of the new AG firepower criteria.

Firepower	**Threshold**	**Goal**
Shell/Fuse Mix	**---TBD---**	
Accuracy - P(Hit) at 1000m	.5	.7
Number Ready Rounds	5	10
Number Stowed Rounds	40	60
Penetration (mm of rolled homogeneous steel at 2000m)	300	400

1.2 Evaluation Criteria for Production

Schedule	**Requirements**	
	Threshold	**Goal**
Growth to 25mm Chain Gun	**Prototype avail. end of 1st yr; Production 2nd yr of Buy**	**Now**
Production Base		
Capability	**10/mo w/in 1 yr of contract**	**20/mo**
Prior Production	**Never produced or always late**	**Never Late**
Lead Times (delivery of first vehicle)	**12 mo**	**1 mo**

Quality Assurance	Requirements	
	Threshold	Goal
Past Performance	No Record or Always Problem	Good Record
Capabilities	None Existing	Exp.People/ Process
Plan	None	Good,Well-Tested
ILS		
Technical Publications	Min Contractor Pubs Required for Testing	Ability Provide all Pubs in USMC Format by IOC
Provisioning	No Spare Parts Planning	Ability Provide all Spares in 1st 2 yrs of Prod
Maintenance Support	No Tech Reps or Maint Prog	Tech Reps Avail & Existing,Good Maint Prog
Training	No Plan for Test & Prod Training	Plan & Ability Meet Training Needs for Test & Prod
Support Equipment	All Support Equip Peculiar to USMC	All Support Equip Existing in USMC
Past Performance	No Exp or Always Problem	Excellent Record

ILS (Cont'd)

	Requirements	
	Threshold	Goal
Logistic Support Analysis		
Baseline Analysis	Sketchy & Incompatible w/ USMC structure	Detailed & Compatible w/USMC structure
Capability for Full LSA	Non Described	Detailed discussion of Method. & Expertise for Full LSA
Project Management		
Technical Staff	Small,Little Qualifications or Hi Turnover	Large,Qualified Low Turnover
Subcontractors	Undefined Control over Many,Unreliable Contractors	Good Control over Small # of Reliable Contractors
Past Performance	Bad Record	Excellent Record
Plan/Organization	Sketchy Plan Long Chain of Command	Detailed Plan, Direct Chain to CEO
Configuration Management	No Plan	Detailed Drawings, Lists & Plan for Tracking Charges

Variants	Requirements Threshold	Goal
Air Defense		
Design Concept	Inadequate	Meets Rqmts Low Risk
Availability	5 yrs	Now
C^2		
Design Concept	Inadequate	Meets Rqmts Low Risk
Availability	5 yrs	Now
Logistic		
Design Concept	Inadequate	Meets Rqmts Low Risk
Availability	5 yrs	Now
Mortar		
Design Concept	Inadequate	Meets Rqmts Low Risk
Availability	5 yrs	Now
Engineer		
Design Concept	Inadequate	Meets Rqmts Low Risk
Availability	5 yrs	Now
Anti-Tank		
Design Concept	Inadequate	Meets Rqmts Low Risk
Availability	5 yrs	Now
Maintenance/Recovery		
Design Concept	Inadequate	Meets Rqmts Low Risk
Availability	5 yrs	Now
Ambulance		
Design Concept	Inadequate	Meets Rqmts Low Risk
Availability	5 yrs	Now
Assault Gun		
Design Concept	Inadequate	Meets Rqmts Low Risk
Availability	5 yrs	Now

Numerical Score Range	Description
76-100	Excellent. Proposal submission on criterion is comprehensive and complete with few or no omissions of consequence. Exemplifies complete understanding of requirements and demonstrates in detail how to accomplish program objectives. Exceeds all major requirements and objectives.
51- 75	Good. Meets the Request for Proposal (RFP) requirements on criterion. Omissions are of minor consequence. High probability of providing an acceptable item.
26- 50	Adequate. Generally meets RFP requirements on criterion. Omissions are significant, but in minor areas, and are correctible. Expected to deliver an acceptable item.
1- 25	Marginal. Proposal barely meets program requirements on criterion. Omissions are frequent and substantial, but have correction potential.
0	Minimum Acceptable/Threshold.
May request further clarification of bidder	Inadequate. A proposal which cannot be expected to meet minimum program requirements, or involves high risk of failure. Proposal has major omissions, or correction requires drastic reorientation/revisions.
	Non-Responsive. Proposal does not satisfy program requirements. Submittals are immaterial or completely erroneous. No understanding of requirements. No data provided on which to base an evaluation.

NUMERICAL SCORES/ADJECTIVAL DEFINITIONS - TECHNICAL PERFORMANCE AND PRODUCTION

END

DATE
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